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Vector power inverter

FA-3HX007

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FA-3HX075

User manual

v. 1.1.3

Information on safe use of the power inverter is marked with symbols. All information and recommendations bearing these symbols should be strictly obeyed.

	Risk of electric shock.
	Potentially dangerous situation that could lead to a danger for the operating personnel or damage to the inverter.
Information concerning the design, operation and maintenance of the power inverter.	
	Important information, valuable tip.
	Practical advice, problem solution.
	An example of use or operation.

Table of contents

Part 1. Unpacking and checking

Before installing and running the inverter it is necessary to:

1) Check that the device wasn't damaged during the transport.
2) Check that the received product is in compliance with the order based on the rating plate.

In case of damages, missing parts or discrepancies, please contact the supplier immediately.

Rating plate

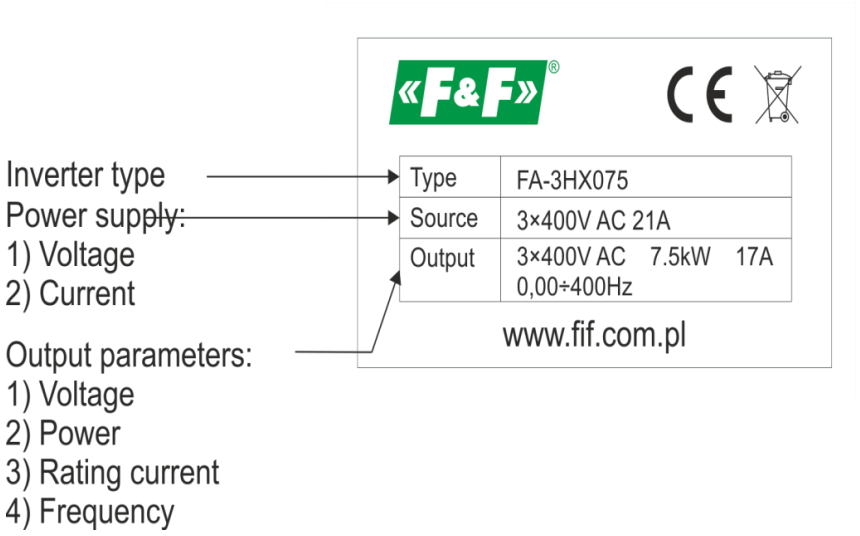


Figure 1) Rating plate of the inverter

Inverter type identification

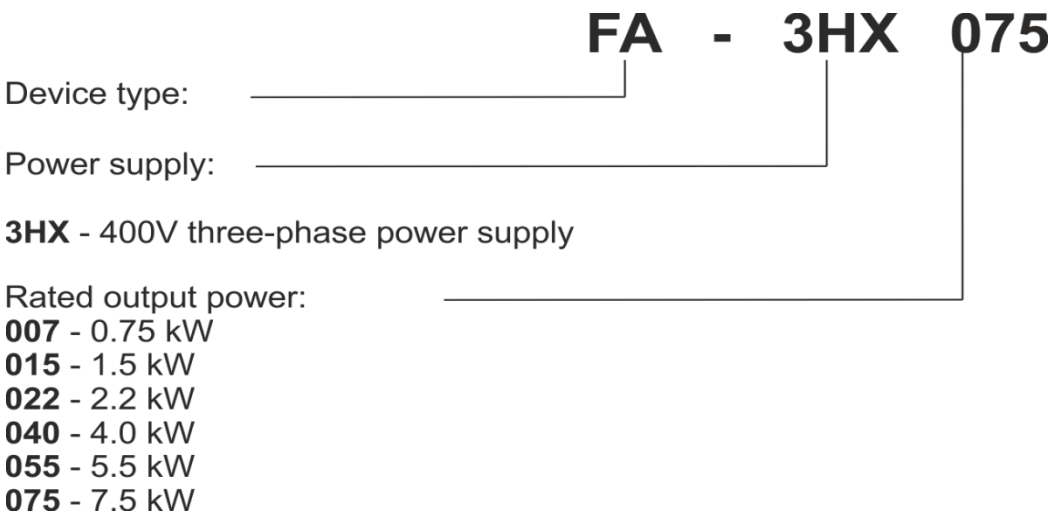


Figure 2) Inverter type identification

Part 2. Installation

Security measures

	**Do not, under any circumstances, connect the supply voltage to the output terminals of the inverter. Violation of this requirement will damage the inverter and threatens to cause a fire.**	
	Do not allow any foreign objects, such as pieces of electrical wires or metal fillings from the control cabinet mounting, to get into the inverter.	
	Close the cover of the inverter before turning on the power, paying close attention not to damage any connected electrical wires while closing it.	
	Any assembly work or control operations are prohibited when the inverter power is switched on.	
	To avoid the risk of electric shock when the inverter is switched on, refrain from contact with any elements inside the inverter.	
	After turning off the power voltage, the internal circuits of the inverter may still contain voltage that pose a threat to life. To avoid electric shock, wait at least 5 minutes after the power is turned off and the control lights on the control panel are turned off.	
	Static electricity accumulated in the human body may pose a major threat to the inverter electronics. To avoid damaging the inverter, do not touch the PCBs and electronic components inside the enclosure with your hands.	
	Stop the motor operation before powering off the inverter.	
	Do not, under any circumstances, break the connection between the inverter and the motor (for example by opening the contactor between the inverter and the motor) while the motor is running.	
	Ground terminal of the inverter must be connected securely and effectively with the grounding of the control cabinet and the electrical system. **Please note: the inverter is designed to work in the TN-S supply network with an effective grounding. Failure to comply with this requirement may lead to the emergence of the dangerous potentials on the metal elements of the inverter casing which are high risk for both the user as well as the inverter itself.**	

Mounting

In order to ensure proper and safe operation of the inverter, it must be installed vertically on a non-flammable wall or mounting plate. In addition, the installation must meet the following conditions:

1) Ambient temperature in a range of -10 to +40°C;
2) Ensured air circulation between the inverter casing and the surroundings;
3) Protection against drops of water, water vapor, dust, iron fillings and other foreign objects getting inside the inverter casing;
4) Protection against the effects of oils, salts, aggressive and explosive gases;
5) Provided adequate space between the inverter and the adjacent objects as shown on the picture below.

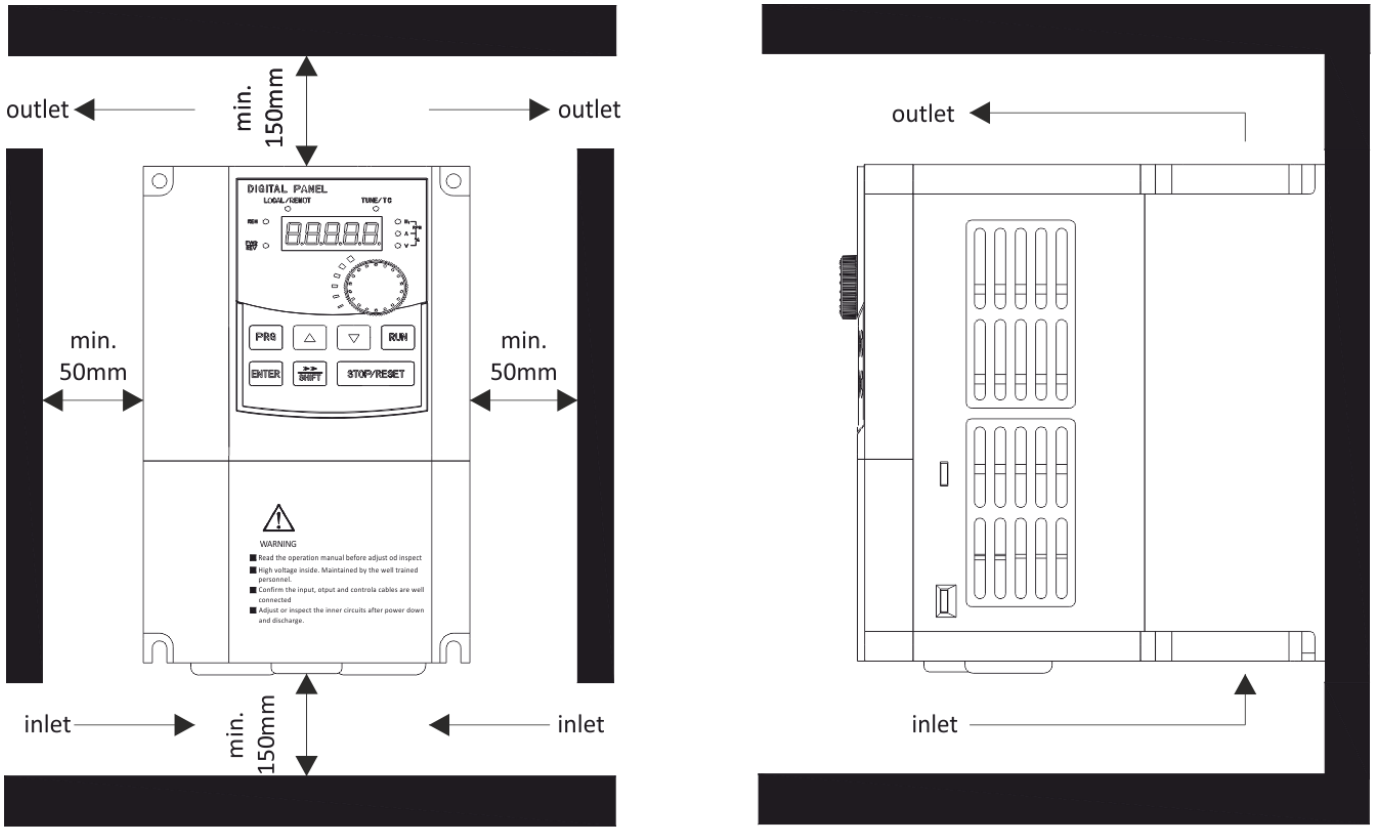


Figure 3) Example of the correct installation of the inverter

Part 3. External connections

Wiring diagram

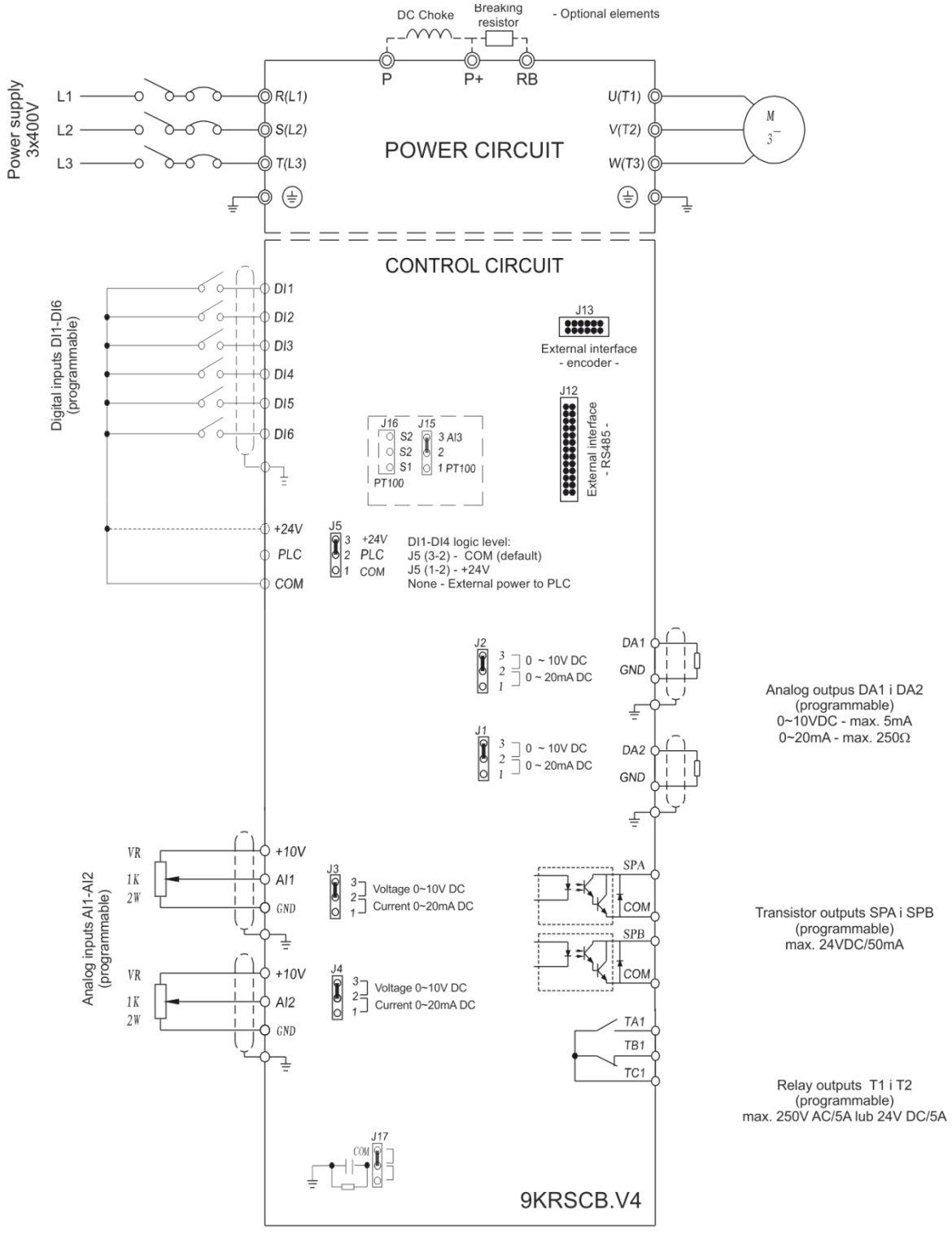


Figure 4) Wiring diagram (control board v4)

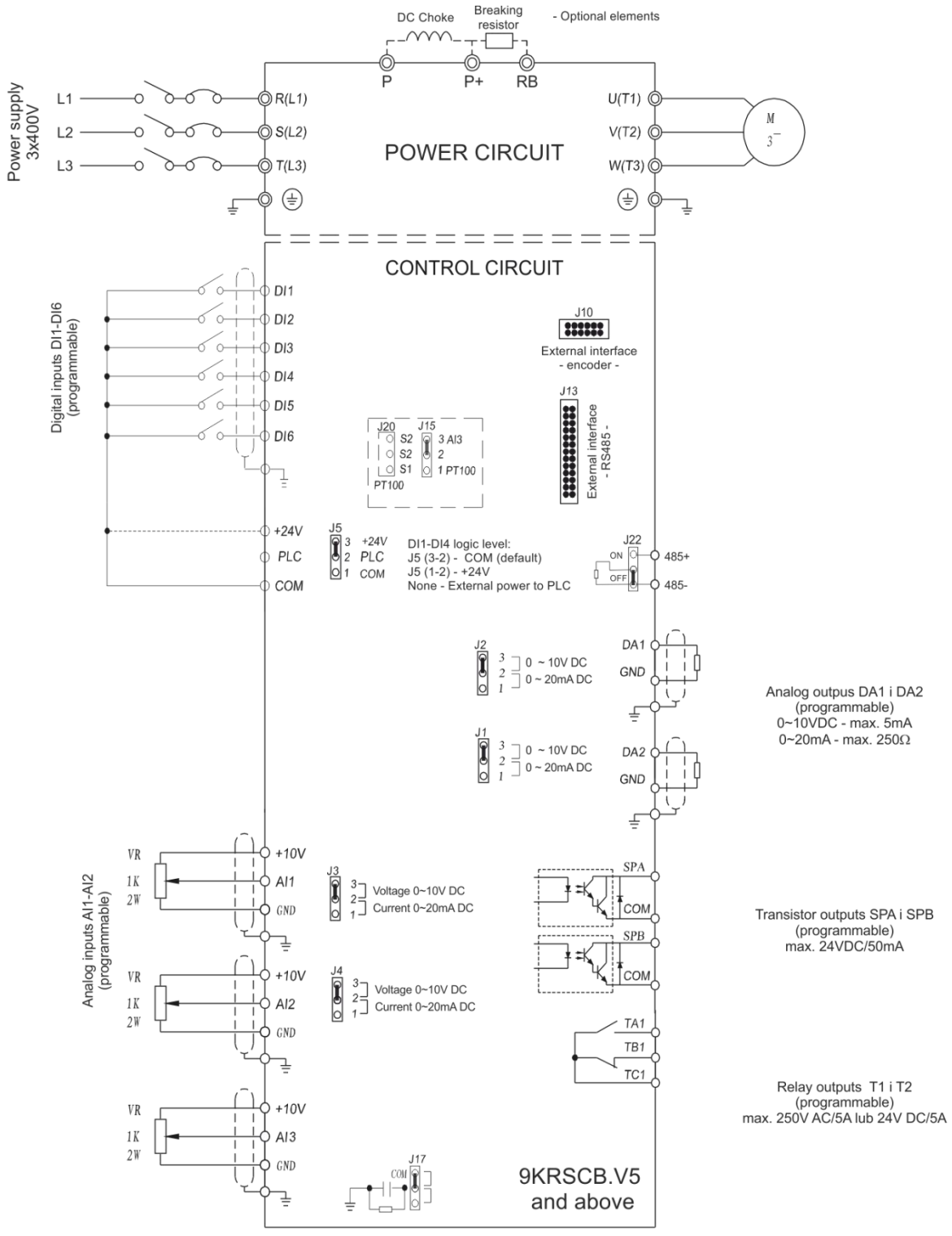


Figure 5) Wiring diagram (control board v5 and above)

Connecting the power circuits

⚠	The power supply of the inverter must be connected in accordance with all applicable standards. The minimum diameter of power cables should be consistent with the guidelines in the table "Selection of power cables and overcurrent protection". When using long cables it is recommended to increase the diameter of the wires.	⚠
⚠	If the switching frequency of the inverter output does not exceed 3 kHz, the maximum cable length between the inverter and the motor cannot exceed 50 m. At higher switching frequencies, this length may be reduced.	⚠
📝	It is recommended to use dedicated, shielded motor power cables between the inverter and the motor.	📝

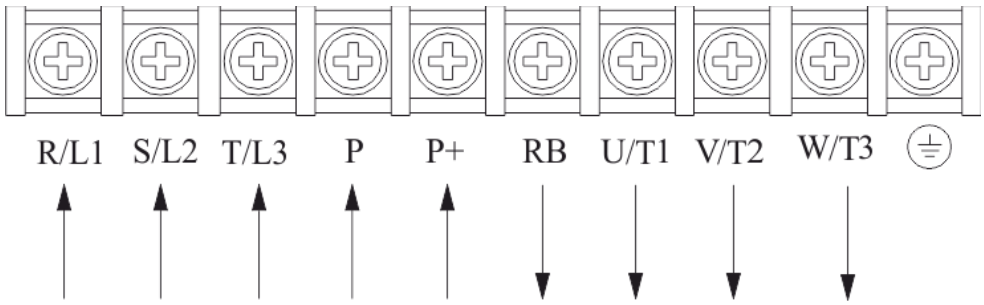


Figure 6) Terminal block to connect power circuits

Terminal	Function	Comments
R/L1 S/L2 T/L3	Inverter power supply	📝 The order of connection of the L1, L2, L3 phases does not matter both for the operation of the inverter and the motor rotation direction.
P, P+	DC choke	Terminals for connecting an optional choke on the DC track. In the absence of the choke, the terminals must be connected by a bridge (default).
U/T1 V/T2 W/T3	Motor	Terminals for connecting motor.
⏚/PE	Ground	⚠ It is necessary to ensure an effective grounding of the inverter and motor.

Selection of ground cables and overcurrent protection

Inverter type	Input current	Output current	Maximum motor power	Protection	Wires diameter
	A	A	kW	A	mm^2
FA-3HX007	4.3	2.5	**0.75**	10	1.5
FA-3HX015	5.0	3.8	**1.5**	16	1.5
FA-3HX022	5.8	5.1	**2.2**	16	2.5
FA-3HX040	10.5	9.0	**4.0**	25	2.5
FA-3HX055	14.6	13	**5.5**	25	4
FA-3HX075	20.5	17	**7.5**	40	4

Connecting the control circuits

⚡	Pay particular attention to the separation of the control circuits from power circuits. An accidental connection of the two circuits may result in electric shock to the user and/or damage to the inverter.	⚡
⚠	Pay attention to the maximum allowable voltage that can be applied on the control inputs of the inverter and to the maximum load of the controller outputs. Exceeding these values may damage the inverter.	⚠
📄	It is recommended to use shielded cables when using analog inputs and outputs.	📄
📄	If possible, use current signals (0-20 mA or 4-20 mA) rather than voltage signals when the analog signals are transmitted over greater distances.	📄

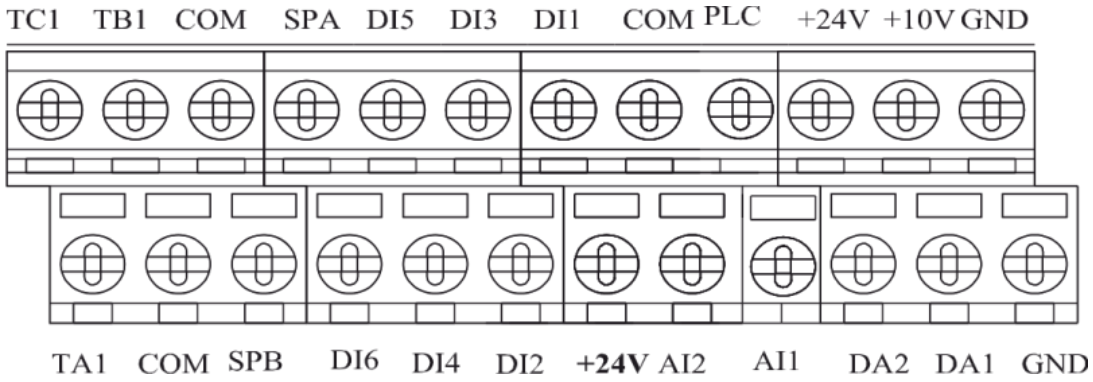


Figure 7) Terminal block for connection of control circuits (9KRSCB.V4)

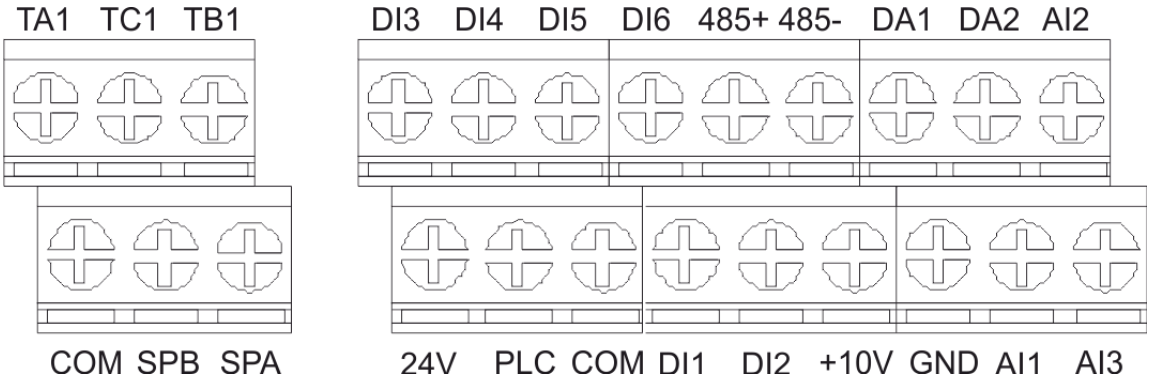


Figure 8) Terminal block for connection of control circuits (9KRSCB.V5 and above)

	Terminal	Function	Comments
Power supply	+10V	+10 V Auxiliary power supply outputs	The auxiliary power supply designed primarily for potentiometers connected to the analog inputs of the inverter.
	GND		⚠ The maximum allowable load of the +10 V power unit is 10 mA. Exceeding the maximum current may damage the power unit. **Please note:** Do not, under any circumstances, connect the GND (ground of the **+10 V** power unit) terminal with the **COM** terminal (ground of the **+24 V** power unit).
	24V	+24 V Auxiliary power supply outputs	+24 V auxiliary power supply can be used to trigger digital inputs and outputs as well as a power source for sensors connected to the inverter.
	COM		⚠ The maximum allowable load of the +24 V power unit is 200 mA. Exceeding the maximum current may damage the power unit. **Please note:** Do not, under any circumstances, connect the GND (ground of the **+10 V** power unit) terminal with the **COM** terminal (ground of the **+24 V** power unit).
	PLC	Power supply terminal of the control circuits	Terminal for selecting the control logic of the DI1-DI6 inputs: • Terminal **PLC** connected to the **COM** terminal - inputs **DI1-DI6** triggered by high level **+24 V** • Terminal **PLC** connected to the terminal **+24 V** - inputs **DI1 - DI6** triggered by low level **COM**.
			⚠ **Please note**: remove jumper J5 when using an external **PLC** terminal for configuring the logic of **DI1-DI6** inputs. Leaving it may cause a short circuit in the power supply and damage to the inverter.
Digital input	DI1	Multi-function digital input 1	**Multi-function inputs terminals** - galvanically separated inputs (optically) - allowable input voltage: 9 – 30 V DC

	Terminal	Function	Comments
	DI2	Multi-function digital input 2	- input impedance 2.4 kΩ **Input logic:** Inputs DI5 - DI8 - jumper J5: • closed (default) - input triggered by low level (COM). • open - input triggered by high level (+ 24 V) Functions performed by the inputs are defined in parameters: **F1.00** – Input configuration DI1 **F1.01** – Input configuration DI2 **F1.02** – Input configuration DI3 **F1.03** – Input configuration DI4 **F1.04** – Input configuration DI5 **F1.05** – Input configuration DI6 **DI5** input can be used as a high-speed pulse input (maximum frequency of 100 kHz)
	DI3	Multi-function digital input 3	
	DI4	Multi-function digital input 4	
	DI5	Multi-function digital input 5	
	DI6	Multi-function digital input 6	
Analog inputs	AI1	Multi-function analog input AI1	• Operating mode (voltage or current) is selected with the **J3** jumper. Jumper closed (default) – voltage input 0-10 V. Jumper open – current input 0 – 20 mA. • Input impedance 22 kΩ for voltage input or 500 Ω for current input.
	AI2	Multi-function analog input AI2	
	AI3 (1)	Multi-function analog input AI3	
Transistor outputs	SPA	Multi-function transistor output	**Multi-function transistor outputs terminals** • galvanically separated outputs (optically) of the open collector (OC) type • allowable voltage: 0 – 24 V DC • allowable current load: 0 – 50 mA • input impedance: 2.4 kΩ **Please note**: SPB output can be configured to work as a normal output or high-speed output (with a maximum output frequency of 100 kHz).The operating mode (normal – high-speed) is selected by parameter **F2.00**. Functions performed by the transistor outputs are
	COM		
	SPB		

	Terminal	Function	Comments
	COM		defined in parameters: **F2.04** – Output configuration SPA **F2.01** – Output configuration SPB (normal output) **F2.06** – Output configuration SPB (high-speed output)
Relay outputs	TA1	Relay output T1 – Contact NO	Multi-function relay output T1 The maximum contact load (both NO and NC): **5 A/250 V AC** **5 A/30 V DC** Functions performed by the relay outputs are defined in parameter **F2.02**.
	TB1	Relay output T1 – Contact NC	
	TC1	Relay output T1 – Contact COM	
Analog outputs	DA1	Multi-function analog output DA1	Output signal logic is set with jumper **J2**: Position 1-2) Current output 0…20 mA Position 2-3) Voltage output 0…10 V DC This function is carried out by the **DA1** output and configured using parameter **F2.07**.
	GND		
	DA2	Multi-function analog output DA2	Output signal logic is set with jumper **J1**: Position 1-2) Current output 0…20 mA Position 2-3) Voltage output 0…10 V DC This function is carried out by the **DA2** output and configured using parameter **F2.08**.
	GND		
Communication	485+(1)	RS485 difference signal positive line	RS485 communication interface
	485- (1)	RS485 difference signal negative line	

(1) Available on control board 9KRSCB.V5 and above.

Part 4. Control panel

Description of control panel items

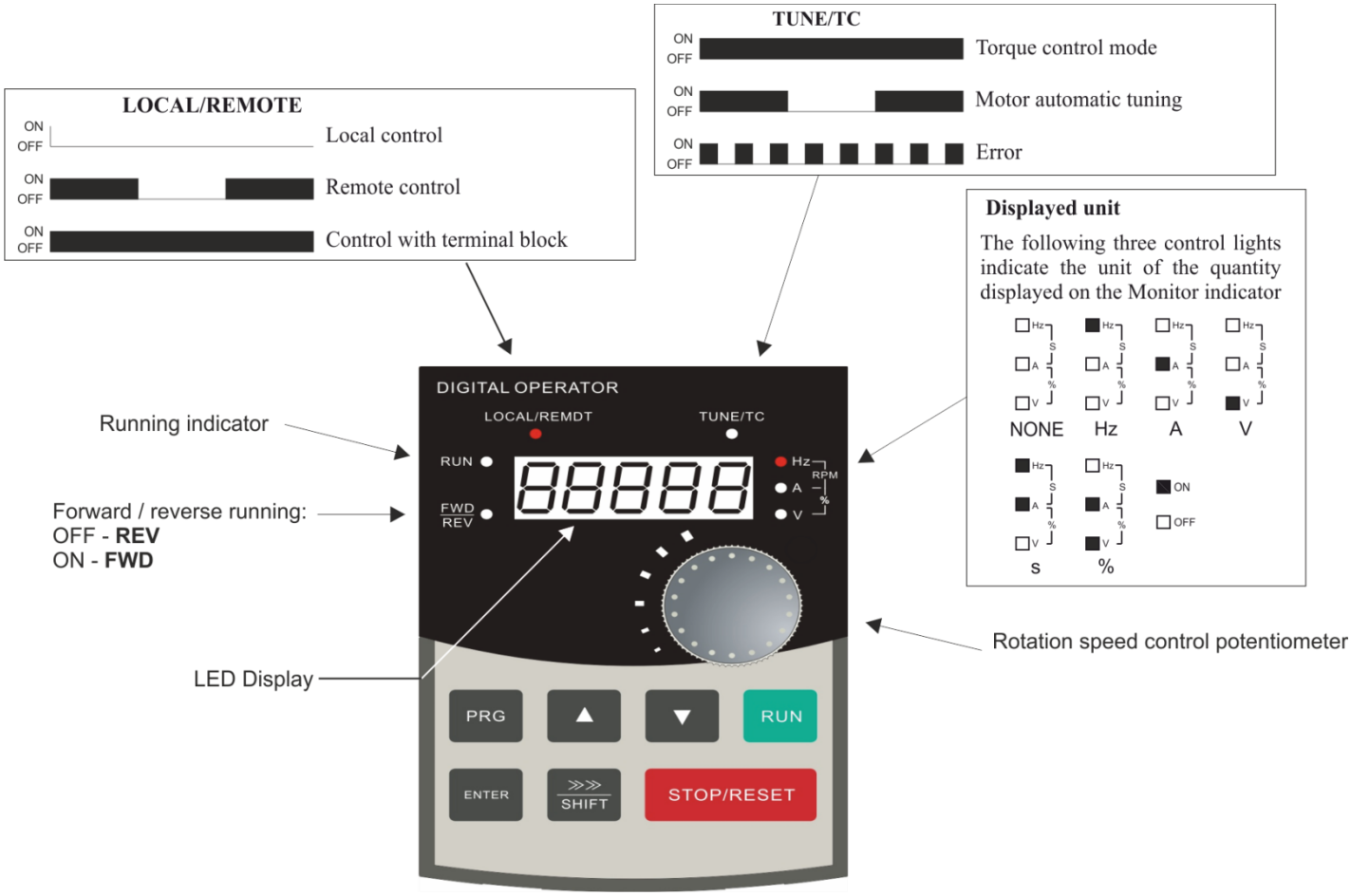


Figure 9) Control panel - indications

Button	Function description
PRG	• In status display mode – open main configuration menu of the inverter. • In menu display mode – go to the higher menu level. • In parameter edit mode – exit edit mode without saving changes.
SHIFT	• In status display mode – switch between the displayed status values. • In parameter edit mode – go to the next parameter digit edition.
▲ ▼	• In menu display mode – switch between the subsequent parameters in the current parameters group. • In the parameter values set mode – **Up** and **Down** buttons allow to increase and decrease the value of parameter that is being edited.

Button	Function description
ENTER	• Confirm new value of the parameter and exit the parameter edit mode.
RUN	• Start motor (if the inverter is configured to control using the operator panel)
STOP/RESET	• Stop motor (if the inverter is configured to control using the operator panel) • Confirm error and clear error notification.

Table 1) Control panel – buttons description

How to use the control panel of the inverter and set parameters values is shown in Figure 8 and Figure 9.

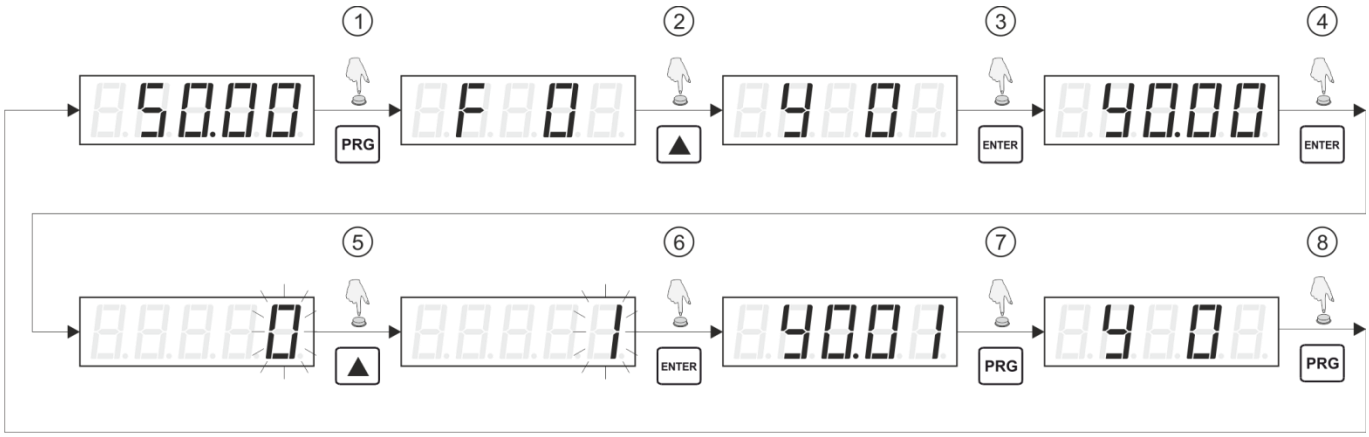


Figure 10) Example – restoring default configuration

1. Press **PRG** button in the monitor display mode to enter menu mode and display the symbol of the first group of parameters (**F0**).
2. Using **UP** and **Down** buttons go to the correct parameters group – in this case group **Y0**.
3. Press **ENTER** to enter the selected group of parameters and display the first parameter of the group (**Y0.00**)
4. Press **ENTER** to edit the selected parameter (**Y0.00**) and display the value of the edited parameter. Edited value is indicated by the flashing of the corresponding digit.
5. Using **Up** and **Down** buttons set the desired value of the parameter – in this case 1.
6. Press **ENTER** to confirm new value of the parameter and exit the edit mode.

Please note: To exit the parameter edit mode without saving changes, press **PRG**.

7. Press **ENTER** to go the higher menu level – **Y0.**
8. Press **ENTER** to enter the status display mode.

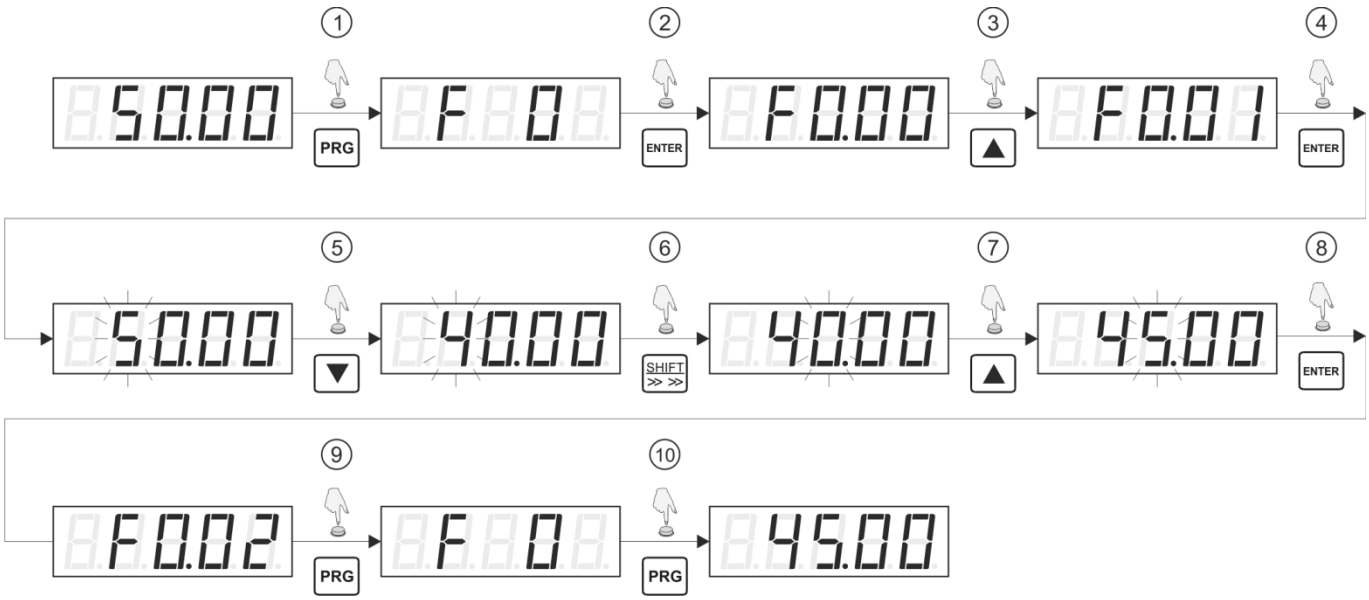


Figure 11) Example - change the set frequency

1. Press **PRG** button in the monitor display mode to enter menu mode and display the symbol of the first group of parameters (**F0**).
2. Press **ENTER** to enter the selected group of parameters and display the first parameter of the group (**F0.00**).
3. Using **Up** or **Down** buttons select the desired number of the parameter – in this case **F0.01**
4. Press **ENTER** to edit the selected parameter (**F0.01**) and display the value of the edited parameter. Edited value is indicated by the blinking of the corresponding digit.
5. Using **Up** and **Down** buttons set the desired value of the parameter digit.
6. Press **SHIFT** to move the edit box to the next position.
7. Using **Up** and **Down** buttons set the desired value of the digit.
8. To edit next digits of the parameter you need to repeat steps 5 and 6. When all digits of the parameter are set, confirm the new value by pressing **ENTER** button**.**
   Please note: To exit the parameter edit mode without saving changes, press **PRG.**
9. Press **ENTER** to go to the higher menu level – **F0.**
10. Press **ENTER** to go to the status display mode.

State of the inverter

The current status of the power inverter can be monitored via the parameters displayed on the LED display located on the operator panel. If the inverter is in the status display mode (which means that menu of the inverter is not displayed and parameter edit mode is not active), then you can switch between displayed values by using **SHIFT** button. List of displayed parameters depends on whether the motor is running or stopped.

If the motor is running, it is possible to display a total of 32 different parameters. They are, among other things, information about: current and preset frequency, DC track voltage supply, output voltage and output current, motor power, status of inputs and outputs (both analog and digital).

If the motor is stopped, it is possible to display values of 16 different parameters. They are, among other things, information about preset frequency, DC track voltage supply, status of inputs and outputs (both analog and digital)...

	The list of parameters that will be displayed in the status mode while the engine is running is configured with parameters **F6.01** and **F6.02**. In contrast, the list of parameters displayed in the status mode when the engine is stopped is configured using parameter **F6.03**.	

Settings protection

It is possible to secure the settings of the inverter from unauthorized access. To do this, set the parameter **Y0.01** to a non-zero value. The value written in the parameter **Y0.01** (in the range of 1 to 65535) will be the new password required to access the configuration of the inverter.

	If the inverter is secured from configuration changes with a password, then pressing the **PRG** button and attempting to enter the menu will result in string ----- being displayed. To gain access to configuration, enter the correct password and confirm by pressing the **PRG** button again. To disable the configuration access protection, first enter the correct password, then enter the parameter **Y0.01** and set its value to zero.	

	If you set a password, make sure that it has not been lost or forgotten, as this may lead to the inability to change the configuration of the inverter.	

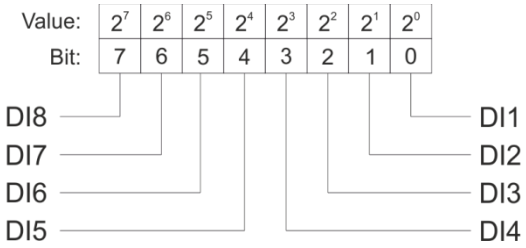
Part 5. Configuration of the inverter

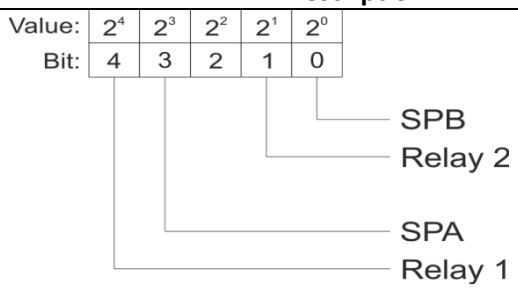
Groups of parameters

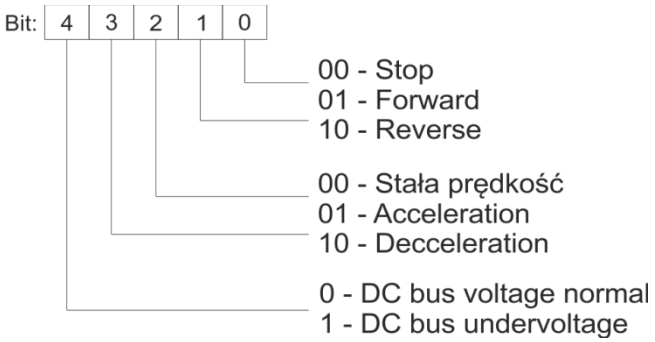
Code	Group	Description	More information (page)
d0	Monitoring functions	Parameters responsible for the information displayed on the LED display of the inverter in the monitoring mode (normal operation of the inverter).	20
F0	Basic functions	Basic configuration of the inverter, including, among other things: • selection of the motor control method (U/f control or vector control) • selection of the start and stop method of the motor • speed setting source • acceleration and deceleration time	23
F1	Inputs functions	Digital and analog inputs configuration	34
F2	Outputs functions	Digital and analog outputs configuration	45
F3	START-STOP functions	Parameters of motor start and stop method, including: • acceleration and braking curve • method of motor stopping (braking or coast to stop) • DC braking and braking module configuration.	50
F4	U/f characteristic	Group of parameters that allows to define an individual U/f control characteristic.	54
F5	Vector control	Parameters for configuring the motor operation with active vector control mode.	57
F6	Operator panel	The parameters that configure the operation of the operator panel, including: • method of action for the **STOP** button • configuration of the parameters displayed in the status mode • information on operation time, temperature etc.	59
F7	Auxiliary parameters	Parameters related to, among other things, operation in JOG mode, defining the prohibited ranges of frequency, allowing rotation in both directions.	61
F8	Security	Configuration of the inverter security.	68
F9	Communication	Configuration of RS485 communication	73
FA	Torque control	• Operating mode selection (speed control or torque control) • Inverter configuration in torque control mode.	74
E1	PLC mode	Parameters configuration in multi-speed mode and	75**Błąd! Nie**

Code	Group	Description	More information (page)
		parameters related to a simple PLC control.	**zdefiniowano zakładki.**
E2	PID controller	Parameters of the built-in PID controller which allows using the inverter to build a feedback loop.	77
b0	Motor parameters	Configuration of the parameters of the motor connected to the inverter.	81
y0	Security and default settings	Setting an access code for the inverter and restore default settings	83
y1	Errors	Inverter errors registry.	84

Monitoring functions

Code	Function	Description	Unit
d0.00	Preset frequency	Output frequency setpoint.	Hz
d0.01	Set frequency	Actual value of output frequency.	Hz
d0.02	DC voltage	DC voltage value on the intermediary link of the converter.	V
d0.03	Output voltage	Effective value of the output voltage.	V
d0.04	Output current	Effective value of the output current.	A
d0.05	Output power	Current value of the active power drawn by the motor.	kW
d0.06	Output torque	Current value of the thrust torque – value relative to the rated value calculated based on the data of the connected motor.	%
d0.07	State of digital inputs	State of digital inputs. Parameter is stored in the form of hexadecimal number with values in the range of 0x00 to 0xFF according to the following diagram:  One bit of the parameter value **d0.07** corresponds to one of the inputs. Bit value **1** means active input, value **0** – inactive input.	-
d0.08	State of digital outputs	State of digital outputs. Parameter is stored in the form of hexadecimal number with values in the range of 0x00 to 0x1F according to the following diagram:	-

Code	Function	Description	Unit
		 One bit of the parameter value **d0.08** corresponds to one of the outputs. Bit value **1** means active output, value **0** – inactive output.	
d0.09	Analog input **AI1**	Voltage value on the analog input **AI1**.	V
d0.10	Analog input **AI2**	Voltage value on the analog input **AI2**.	V
d0.11	Potentiometer setting	Value of the voltage set with the potentiometer located on the operator panel.	V
d0.12	Pulse counter	Number of pulses counted during operating time using the pulse inputs.	-
d0.14	Motor speed	Actual motor speed converted to revolutions per minute.	rpm
d0.15	PID – setpoint	Setpoint of the PID control system.	%
d0.16	PID – feedback	Feedback value in the PID control system.	%
d0.17	PLC – Step	In the PLC control mode, parameter **d0.17** indicates which step of the program is currently executed.	-
d0.18	High-speed pulse input	Frequency of the signal connected to the high-speed pulse input.	kHz
d0.20	Remaining operation time	If the inverter is set to a predetermined operating time (for example in PLC mode), then parameter **d0.20** indicates the time remaining to complete the operating cycle.	min
d0.21	Linear speed	Linear speed calculated on the basis of rotational speed and diameter of the shaft.	$^{m}/_{min}$
d0.22	Switch-on time	The time that has elapsed since the last inverter powering.	min
d0.23	Operation time	Current motor running time (measured from the moment of the last inverter powering).	min
d0.24	High-speed pulse input	Frequency of the signal connected to the high-speed pulse input.	Hz
d0.25	Preset state	Value of state (frequency, torque or other) preset in the inverter using remote communication port.	%
d0.27	Preset frequency – main source	The frequency set using main source of frequency setting. **Please note:** Main frequency source is selected using the parameter **F0.03**.	Hz
d0.28	Preset frequency – auxiliary source	The frequency set using auxiliary source of frequency setting. **Please note**: Auxiliary frequency source is selected using	Hz

Code	Function	Description	Unit
		the parameter **F0.04**.	
d0.29	Thrust torque – setpoint	Thrust torque setpoint, converted to the rated thrust torque of the motor. **Please note**: This option is active only when the inverter operates in torque control mode.	%
d0.35	Current state of the inverter	State of the inverter is described in a bit form. The meaning of individual bits of the **d0.35** parameter is shown in the following figure: 	-
d0.37	Input **AI1** – previous state	Previous value of the voltage on analog input **AI1**.	V
d0.38	Input **AI2** – previous state	Previous value of the voltage on analog input **AI2**.	V
d0.39	Potentiometer – previous state	Previous value of the voltage on the potentiometer located on the operator panel.	V

Basic functions

Code	Descriptions	Settings		Unit	Def.	Block
F0.00	Control mode	Sensorless vector control	0	-	2	Y
		Sensor vector control (requires encoder and additional PG expansion card).	1			
		Control according to the U/f curve (scalar control).	1			

1. **Sensorless vector control**

   Drive control based on the accurate model of the electric motor. It ensures a far better quality of speed and torque regulation over a very wide range of frequency. Sensorless vector control is designed to operate in a system with one motor. For a proper operation, the sensorless vector control requires accurate identification of the motor parameters.

2. **Sensor vector control**

   Drive control based on the accurate model of the electric motor and additional very accurate information from encoder on the actual rotational speed of the motor. Sensor vector control is designed to operate in a system with one motor. It provides the best performance while operating at very low rotational speeds.

   Please note: To use the sensor control it is necessary to use the encoder installed on the motor shaft and to connect the optional PG expansion card to the inverter.

3. **Sensorless vector control**

   Motor control by the U/f characteristic does not make use of the powered motor model, therefore

   It is not recommended for use in case of drives that require high speed dynamic, high values of thrust torque at low frequencies or short accelerating and stopping times of the motor. The U/f control is instead recommended in applications where the inverter operates as a generator with variable frequency or in multi-motor systems.

F0.01	Frequency set via keyboard	Motor operation setpoint.		Hz	50	Y

Parameter **F0.01** can take any value in the range of zero to maximum frequency (parameter **F0.19**).

Please note: If the multi-step control mode or motorized potentiometer mode is set as a source of frequency settings, then parameter **F0.01** allows specifying the initial value of the frequency.

F0.02	Frequency step	Step for frequency setting.	0.1	1	Hz	2	Y
			0.01	2			

Please note: Parameter **F0.02** affects the settings of all quantities associated with a frequency setting.

If the parameter **F0.02** is set to value **1**, then the maximum output frequency can be 3200.0 Hz. If the parameter **F0.02** is set to value **2** (default), then the maximum frequency is 320.00 Hz.

Code	Descriptions	Settings		Unit	Def.	Block	
F0.03	Main source of frequency setting	Keyboard – **Up/Down** buttons, **Up/Down** terminals – values are not preserved in case of a power outage.	0	-	0	Y	
		Keyboard – **Up/Down** buttons, **Up/Down** terminals – values are preserved in case of a power outage.	1				
		Analog input **AI1**	2				
		Analog input **AI2**	3				
		Potentiometer on the operator panel	4				
		High-speed pulse input	5				
		Multi-step mode	6				
		PLC mode	7				
		PID controller	8				
		Remote communications settiing	9				

0 - Keyboard – Up/Down buttons, Up/Down terminals – values are not preserved in case of a power failure.

If you selected value 0, then the motor will start at the frequency set in parameter **F0.01.** To change the frequency, use the **Up/Down** buttons located on the operator panel or the digital inputs with **Up/Down** commands assigned to them. When the power is switched off, the currently set frequency will not be saved.

1 – Keyboard – Up/Down buttons, Up/Down terminals – values are preserved in case of a power failure.

If you selected value 0, then the motor will start at the frequency set in parameter **F0.01.** To change the frequency, use the **Up/Down** buttons located on the operator panel or the digital inputs with **Up/Down** commands assigned to them. Change of frequency automatically changes the value of parameter **F0.01**, so after power outage and its subsequent return the motor will start from the last set frequency value.

Please note: Parameter **F0.09** additionally defines the behavior of the currently set frequency when the motor is stopped. Value of **F0.09** parameter has no effect on the behavior in case of a power outage.

2 – Analog input AI1

3 – Analog input AI2

4 – Potentiometer on the operator panel

Analog inputs **AI1** and **AI2** can operate both as a 0..10 V voltage input and 2..20 mA current input (depending on the settings of **J1** and **J2** jumpers - **Błąd! Nie można odnaleźć źródła odwołania.**). otentiometer on the operator panel works only in the voltage mode with output signal of 0...5 V.

Code	Descriptions	Settings		Unit	Def.	Block	
		Detailed dependency between the value of input analog signal and the output frequency is specifically configured using parameters **F1.12**...**F1.25**. **5 – High-speed pulse input** The FA-3X… inverter is designed to control the rotational speed with a frequency signal. In this case, the dependency between the input frequency and the output frequency is configured with **F1.26**...**F1.29**.  **Please note:** Only the high-speed pulse input **DI5** can be used for the control in the form of a signal with variable frequency. Acceptable input parameters: - acceptable voltage amplitude: **9...30 V** - maximum input frequency: **100 kHz** **6 – Multi-step mode** Up to four binary inputs can be programmed so that a different combination of the states applied at these inputs will generate different output frequencies. In case of using all four inputs it is possible to set sixteen different speed levels. Detailed configuration of operation in the multi-speed mode is done via parameters **E1.00**...**E1.15**. **7 – PLC mode** In the simple PLC control mode up to sixteen different steps can be defined (defined as a speed, time of acceleration and deceleration, time of operation). Inverter will execute them automatically. Detailed configuration of the PLC mode is done via group **E1** parameters. **8 –PID controller** The source of frequency setting will be used as a source of feedback setpoint. Parameters from **E2** group must be additionally configured for proper operation of the PID controller. **9 – Remote control** Output frequency is set remotely with commands sent via Rs-485 interface and Modbus RTU protocol.						
F0.04	Auxiliary source of frequency setting	Keyboard – **Up/Down** buttons, **Up/Down** terminals – values are not preserved in case of a power failure.	0				
		Keyboard – **Up/Down** buttons, **Up/Down** terminals – state is preserved in case of a power failure.	1				
		Analog input **AI1**	2				
		Analog input **AI2**	3				
		Potentiometer on the operator panel	4				
		High-speed pulse input	5				

Code	Descriptions	Settings		Unit	Def.	Block	
		Multi-step mode	6				
		PLC mode	7				
		PID controller	8				
		Remote communications settiing	9				
Please note: The effects of respective settings are analogous to those from parameter **F0.03** and were further discussed along with it.							
F0.05	Selection of the reference frequency for auxiliary source	Frequency will be set using the auxiliary source in reference to the maximum frequency.	0	-	0	N	
		Frequency will be set using the auxiliary source in reference to the frequency of the main source.	1				
F0.06	Range of changes for auxiliary source of frequency setting	0 – 150%		%	100	N	
Parameters **F0.05** and **F0.06** are used if the link between the main source of the frequency setting and the auxiliary source of the frequency setting is enabled. (parameter **F0.07** = **1**, **3** or **4**). In that case: • Parameter **F0.05** determines whether the span of frequency regulation for auxiliary source will be within the range of 0 to maximum frequency (**F0.05** = **0**), or of zero to frequency specified by the main source of frequency setting (**F0.05** = **1**). • Parameter **F0.06** determines the range of changes introduced by the auxiliary source of frequency. The resultant value of action of frequency setting auxiliary source will be a composition of values from parameters **F0.05** and **F0.06**.							
F0.07	Relation between main and auxiliary source of frequency setting	**The unit digit – x<u>X</u>** – Selection of frequency setting source.		-	00	N	
		Frequency set by the main source.	0				
		The resultant frequency is the result of arithmetic composition of signals from the main source and auxiliary source. Action defining the relation between the main source and the auxiliary source is determined on the second digit of the parameter.	1				
		Switching between main and auxiliary source of` frequency setting.	2				
		Switching between the main source and the arithmetic composition of signals from the main and auxiliary source.	3				
		Switching between the auxiliary	4				

Code	Descriptions	Settings		Unit	Def.	Block
		source and the arithmetic composition of signals from the main and auxiliary source.				
		The tenths digit – Xx – Definition of relations between the main and auxiliary source of frequency setting.				
		Main + Auxiliary	0			
		Main - Auxiliary	1			
		Max(Main, Auxiliary)	2			
		Min(Main, Auxiliary)	3			
		Master * auxiliary / maximym frequnce	4			

Parameter F0.07 allows specifying the relation between the main and the auxiliary source of the frequency setting. Parameter consists of two digits:

1st digit (on unit position):

0 – Frequency setting using main source

Frequency is set only with main source of frequency setting (set with the parameter **F0.03**).

1 – Arithmetic composition of main and auxiliary source

The resultant frequency is the result of an arithmetic operation (set in the second digit of the parameter) between main and auxiliary source of frequency setting.

2 – Switching between main and auxiliary source of frequency setting

The choice of whether the frequency is set with main or auxiliary source is carried out using one of the digital inputs to which the function with the code 18 (switching of frequency setting source - more in the description of the parameters **F1.00**...**F1.07**) is assigned.

If the input to which the function of switching sources is assigned is inactive, then the frequency is set using the main source. If the source switching input is active, then the frequency is set using the auxiliary source.

3 – Switching between the main source and the arithmetic composition of signals from the main and auxiliary source.

Similar to the previous value. If the source switching input is inactive, then the frequency is set using the main source. If the source switching input is active, then the frequency is defined as the result of arithmetic operation (set on the second digit of the parameter) between main and auxiliary sources.

4 – Switching between the auxiliary source and the arithmetic composition of main source and auxiliary source.

Similar to the two previous values. If the source switching input is inactive, then the frequency is set using the auxiliary source. If the source switching input is active, then the frequency is defined as the result of arithmetic operation (set on the second digit of the parameter) between main and auxiliary sources.

2nd digit (on tenths position):

This setting is justified only if the first digit of the parameter forces the execution of the frequency composition from the main and auxiliary sources.

0 – Main + Auxiliary

The resultant frequency is the arithmetic sum of the frequencies set using man and auxiliary sources.

Code	Descriptions	Settings		Unit	Def.	Block	
1 – Main – Auxiliary The resultant frequency is the result of subtracting the frequency set with auxiliary source from the frequency set with the main source. **2 – Max(Main, Auxiliary)** The frequency is set to the higher of the values that are set at the moment by the main and auxiliary sources of frequency setting. **3 – Min(Main, Auxiliary)** The frequency is set to the lower of the values that are set at the moment by the main and auxiliary sources of frequency setting. **4 - Master * auxiliary / maximium frequnce** (Frequency source master setting * frequency source auxiliary setting) divided by the maximum value of frequency as the frequency command.							
F0.08	Frequency shift	Parameter **F0.08** allows forcing an additional shift in resultant frequency, if the source of frequency setting is set as an arithmetic composition of signals from the main and auxiliary sources. In that case the set frequency will be the result of arithmetic operation between main source and auxiliary source summed up with **F0.08** shift. Frequency shift can be set in the range of 0.00Hz to a maximum value specified by the parameter **F0.19**.		Hz	0.00	N	
F0.09	Frequency setting memory	Set frequency will not be saved after pressing the **STOP** key.	0	-	1	N	
		Set frequency will be saved after pressing the **STOP** key.	1				
If the frequency is set digitally (for example using buttons/terminals **Up/Down**) then the parameter F0.09 allows determining whether the last frequency value will be saved after motor stopping. **0 – Frequency will not be saved** The current frequency setting will be abandoned when the motor is stopped. Next time the motor will start from the initial frequency specified in parameter **F0.01**. **1 – Frequency will be saved** The current frequency setting will be preserved when the motor is stopped. Next time the motor will start from the frequency that was set at the time of the previous motor shut down.							
F0.10	**Up/Down** command action	Current frequency correction	0	-	0	Y	
		Set frequency correction	1				

<table>
<tr><th>Code</th><th>Descriptions</th><th colspan="2">Settings</th><th>Unit</th><th>Def.</th><th>Block</th><th></th></tr>
<tr><td colspan="8">If the frequency is set digitally (for example using buttons/terminals Up/Down) then the parameter F0.10 allows determining whether the Up/Down commands affect the current frequency of the motor or changing the frequency setpoint.

  The difference in parameter F0.10 operation is particularly evident during acceleration/braking with long start-up and braking times. In the first case the Up/Down command affects the current frequency and causes the acceleration/deceleration to perform faster. In the second case the difference reveal itself later – after the new set frequency has been reached.</td></tr>
<tr><td rowspan="5">F0.11</td><td rowspan="5">START – STOP signal source</td><td>Buttons on the control panel</td><td>0</td><td rowspan="5">-</td><td rowspan="5">0</td><td rowspan="5">N</td><td></td></tr>
<tr><td>Control using multi-function digital inputs DI1...DI6</td><td>1</td><td></td></tr>
<tr><td>Remote control (RS485 and Modbus RTU)</td><td>2</td><td></td></tr>
<tr><td>Buttons on the control panel + remote control</td><td>3</td><td></td></tr>
<tr><td>Buttons on the control panel + remote control + terminal input control</td><td>4</td><td></td></tr>
<tr><td colspan="8">Parameter determines how the commands for start and stop of the drive (FWD, REV, JOG) will be issued:
0 – Buttons on the control panel
The commands are issued using buttons located on the control panel of the inverter. This mode is indicated by the turned off LOCAL/REMOTE control light located on the operator panel.
1 – Control using digital inputs DI1...DI8
The commands are issued using suitably programmed digital inputs DI1...DI8 (inputs configuration – parameters F1.00 – F1.07). This mode is indicated by the turned on LOCAL/REMOTE control light located on operator panel of the inverter.
2 – Remote control
The commands are issued using the Rs485 communication port and Modbus RTU protocol. This mode is indicated by the flashing LOCAL/REMOTE control light.
Please note: An optional communication card must be connected to use the remote control capabilities of the inverter.
3 - Buttons on the control panel + remote control
Mode 0 and 1 working together
4 - Buttons on the control panel + remote control + terminal input control
Mode 0, 1 and 2 working together</td></tr>
<tr><td rowspan="3">F0.12</td><td rowspan="3">Linking the source of the frequency setting with the source of the START – STOP signal</td><td colspan="2">Units digit
Linking the frequency sources with START - STOP commands from the operator panel.</td><td rowspan="3"></td><td rowspan="3">000</td><td rowspan="3">N</td><td rowspan="3"></td></tr>
<tr><td>No linking</td><td>0</td></tr>
<tr><td>Buttons on the operator panel</td><td>1</td></tr>
</table>

Code	Descriptions	Settings		Unit	Def.	Block	
		Analog input **AI1**	2				
		Analog input **AI2**	3				
		Potentiometer on the operator panel	4				
		High-speed pulse input	5				
		Multi-speed mode	6				
		PLC mode	7				
		PID controller	8				
		Tenths digit Linking frequency sources with **START** – **STOP** commands issued from the terminal block (meaning of the individual values such as for the first digit).					
		Tenths digit Linking frequency sources with remotely issued **START** – **STOP** commands. (meaning of the individual values such as for the first digit).					

Parameter **F0.12** allows defining linking between sources of START-STOP commands setting and sources of frequency setting. This way, the flexibility of sources switching can be increased.

Example:

If parameter **F0.12** is set to 24, it means that:

1) If the source of **START**-**STOP** commands is set to operator panel, then the frequency will be set with potentiometer located on the operator panel (first digit of the parameter **F0.12** is set to value 4).
2) If the source of **START**-**STOP** commands is set to terminal block, then the frequency will be set with analog input **AI1** (second digit of the parameter F0.12 is set to value 2).

It is possible to link the same source of frequency setting with different setting sources of **START-STOP** commands. If the link between sources is set, then the settings of parameters **F0.03**...**F0.07** are not included.

F0.13	Acceleration time	0.0...6500.0	-	10.0	Y	
F0.14	Deceleration time	0.0...6500.0	-	10.0	Y	

The **F0.13** acceleration time is the time in which the inverter accelerate from zero to reference frequency set in parameter **F0.16**. The **F0.14** deceleration time is the time in which the inverter decelerate from frequency **F0.16** to zero. The unit of time for parameters **F0.13** and **F0.14** is set in parameter **F0.15**.

Code	Descriptions	Settings	Unit	Def.	Block	
		Please note: Too short acceleration/deceleration time, especially in motors with high moment of inertia, causes high load both of the motor windings and the output circuits of the inverter. This may lead to the activation of the overvoltage and overcurrent protection of the inverter.				
The FA-3X inverters allow to define up to four sets of acceleration/deceleration time and to switch between them using signals applied on **DI** digital inputs. In this case, these times are configured with parameters: **F0.13**, **F0.14** – First set **F7.08**, **F7.09** – Second set **F7.10**, **F7.11** – Third set **F7.12**, **F7.13** – Fourth set						
F0.15	Unit of time for acceleration and deceleration	1 second	0	0	N	
		0.1 second	1			
		0.01 second	2			
Parameter **F0.15** decides on what scale will the acceleration and deceleration times be presented. The selected scale on one hand determines the accuracy of time setting, on the other – the maximum acceleration and deceleration time. **0 – 1 second** – Time scale 0 – 65000 s **1 – 0.1 second** – Time scale 0.0 – 6500.0 s **2 – 0.01 second** – Time scale 0.00 – 650.00 s						
F0.16	Reference frequency for acceleration and deceleration	Maximum frequency (**F0.19**)	0	0	N	
		Preset frequency	1			
		100 Hz	2			
F0.16 determines the reference frequency for acceleration and deceleration times. Depending on the value of parameter **F0.16** the acceleration time is calculated as follows: **0 – Maximum frequency (F0.19)** – time of acceleration from zero to maximum frequency (stored in parameter **F0.19**). **1- Preset frequency** – time of acceleration from zero to preset frequency. In that case the acceleration time will be constant regardless of preset frequency, but the actual acceleration of the motor will change (the higher the preset frequency, the greater the acceleration). **2 – 100 Hz** – Time of acceleration from the frequency of 100Hz.						

Code	Descriptions	Settings	Unit	Def.	Block	
		Please note: In cases 0 and 2 the acceleration of the motor is constant. If we assume, for example, that the maximum frequency **F0.19** equals 50 Hz, and the acceleration time is 10 s, then the acceleration time from zero to frequency 25 Hz will be: **F0.16** = 0 -> Time to reach 25 Hz = 5 s **F0.16** = 1 -> Time to reach 25 Hz = 10 s **F0.16** = 2 -> Time to reach 25 Hz = 2.5 s				
F0.17	Changing the switching frequency in the temperature function	No	0	1	N	
		Yes	1			
When the temperature varies, the inverter can automatically correct the switching frequency of the power output in such a way that the switching frequency is reduced at high temperatures and increased at low. This reduces the power losses during the switching of the transistors and also reduces the temperature of the inverter.						
F0.18	Switching frequency	0.5...16.0	-	8	N	

Switching frequency determines the frequency at which the output power transistors are switched and the speed of shaping of the PWM output wave that powers the drive connected to the inverter output. Selection of the correct switching frequency has a very significant effect on the proper operation of the drive and the level of electromagnetic disturbances emitted by the inverter.

If the switching frequency is high, then the sine wave of motor supply voltage is better recreated and thanks to that the motor itself operates better (especially for low frequencies) and quieter. However, high frequency generates much larger electromagnetic interference. Power losses inside the inverter are also higher, which leads to much greater heat emission and may result in damage to the inverter under heavy output load. In addition, there may be a current leakage on cables between the inverter and the motor, and between the motor windings and the housing. This in turn can lead to triggering of residual current protection built into the inverter.

Sample list of drives characteristics for different switching frequencies is presented in the table below:

Switching frequency	Low	High
Motor noise	Big	Small
Sine wave recreation	Weak	Good
Motor temperature	High	Low
Inverter temperature	Low	High
Current leakage	Small	Big
Interference (grid and EMC)	Small	Big

Code	Descriptions	Settings		Unit	Def.	Block	
F0.19	Maximum output frequency	50.00 … 320.00 (3200.0)		Hz	50	Y	
Maximum frequency of voltage and output current of the inverter. If the parameter **F0.02** is set to 2 (default) then the maximum output frequency is 320 Hz. If the parameter **F0.02** is set to 1, then the maximum output frequency is 3200 Hz.  Parameter **F0.19** is the reference value for the frequency set with high-speed pulse input or with digital inputs (multi-speed mode).							
F0.20	Source of upper frequency limit setting	Parameter F0.21	0	-	0	Y	
		Analog input AI1	1				
		Analog input AI2	2				
		Potentiometer on the operator panel	3				
		High-speed pulse input	4				
The maximum output frequency can be set permanently using parameter **F0.21**. The maximum frequency can be also flexibly limited using analog inputs, high-speed pulse input or with remote control (Modbus RTU communication).  Analog or pulse input set to limit maximum frequency can limit only the maximum frequency that is set in parameter **F0.21**. If the set frequency is higher than the value set in parameters **F0.20** – **F0.22**, the output frequency will be limited to the set maximum frequency.							
F0.21	Upper frequency limit	**F0.23** (Lower limit) … **F0.19** (Upper limit)		Hz	50	N	
F0.22	Shift of the upper frequency limit	0.00 … F0.19		Hz	0	N	
Parameter **F0.21** specifies the maximum frequency value that can be set on the output of the inverter. Settings fall within the range of minimum frequency (set with parameter **F0.23**) to maximum frequency (set with parameter **F0.19**). If the upper value of frequency limit (**F0.20**) is set with the analog input or high-speed pulse input, then the parameter **F0.22** allows to specify the shift of the upper frequency limit (in order to eliminate the possibility of setting the maximum frequency to zero).							
F0.23	Lower frequency limit	0.00 (Lower limit) … F0.21 (Upper limit)		Hz	0	N	
If the frequency setpoint is lower than the value set in parameter **F0.23**, then the output frequency will be limited to value **F0.23** or the motor will stop (depending on the setting of parameter **F7.18**).							
F0.24	Rotation direction	Consistent	0	-	0	N	
		Opposite	1				

Code	Descriptions	Settings	Unit	Def.	Block	
Change in parameter F0.24 will allow changing the direction of motor rotation (traditionally defined as "forward"). It is the software equivalent of rotation direction change by changing the order of the two phase wires of the motor.						

Inputs functions

Code	Description	Settings	Unit	Def.	Block
F1.00	Configuration of **DI1** input	0 … 50	-	1	Y
F1.01	Configuration of **DI2** input	0 … 50	-	2	Y
F1.02	Configuration of **DI3** input	0 … 50	-	8	Y
F1.03	Configuration of **DI4** input	0 … 50	-	9	Y
F1.04	Configuration of **DI5** input	0 … 50	-	12	Y
F1.05	Configuration of **DI6** input	0 … 50	-	13	Y
F1.06	Configuration of **DI7** input	0 … 50	-	0	Y

To each of the binary inputs DI1 … DI7 can be assigned one of the fifty available functions. List of available functions and their descriptions are described in the table below.

Value	Command	Description
0	No command	No function is assigned to the input.
1	Forward	Forward moving command.
2	Reverse	Reverse moving command.
3	Stop	Motor stop command (for the three-wire control mode).
4	JOG – Forward	Test forward run.
5	JOG – Reverse	Test reverse run.
6	„**Up**" command	Increasing/decreasing the frequency using **DI** digital inputs.
7	„**Down**" command	
8	Coast to stop	Motor stop using the free coast to stop.
9	Error reset (**RESET**)	Error reset function allows confirming and clearing the error using the **DI** digital inputs. This function works the same way as pressing the **RESET** button on the operator panel.
10	Pause	Activation of the Pause command causes motor to stop while at the same time maintaining all the parameters of the motor operation from before the pause (such as operation step in the PLC mode, state of the PID controller…). When the Pause input is deactivated, the motor starts again and its previous state is restored.
11	Alarm	Alarm input of the NO (normally open) type. Input triggering will lock the inverter and report error **Err.15**.
12	Multi-step control – Bit 1	Four digital inputs to which the multi-speed commands will be assigned. They allow defining up to 16 different speeds which will be selected using combination of input signals applied to the **DI** inputs.
13	Multi-step control –	

Code	Description	Settings	Unit	Def.	Block
	Bit 2				
14	Multi-step control – Bit 3				
15	Multi-step control – Bit 4				

Table of speed combinations in the function of multi-step control settings is presented below:

Bit 4	Bit 3	Bit 2	Bit 1	Command	Parameter
-	-	-	-	Speed 0	**E1.00**
-	-	-	**ON**	Speed 1	**E1.01**
-	-	**ON**	-	Speed 2	**E1.02**
-	-	**ON**	**ON**	Speed 3	**E1.03**
-	**ON**	-	-	Speed 4	**E1.04**
-	**ON**	-	**ON**	Speed 5	**E1.05**
-	**ON**	**ON**	-	Speed 6	**E1.06**
-	**ON**	**ON**	**ON**	Speed 7	**E1.07**
ON	-	-	-	Speed 8	**E1.08**
ON	-	-	**ON**	Speed 9	**E1.09**
ON	-	**ON**	-	Speed 10	**E1.10**
ON	-	**ON**	**ON**	Speed 11	**E1.11**
ON	**ON**	-	-	Speed 12	**E1.12**
ON	**ON**	-	**ON**	Speed 13	**E1.13**
ON	**ON**	**ON**	-	Speed 14	**E1.14**
ON	**ON**	**ON**	**ON**	Speed 15	**E1.15**

16	Acceleration/Deceleration – Bit 1	Two digital inputs to which the acceleration and deceleration times' selection commands will be assigned. They allow selecting up to four combinations of acceleration and deceleration times using combination of signals applied to the **DI** inputs. Acceleration and deceleration times associated with the next steps are defined in the parameters :,,,.
17	Acceleration/Deceleration – Bit 2	

The table below is a list of possible combinations of inputs responsible for the acceleration and deceleration and their corresponding settings.

Bit 2	Bit 1	Command	Parameters
-	-	Set 1	**F01.13** - **F0.14**
-	**ON**	Set 2	**F7.08** - **F7.09**
ON	-	Set 3	**F7.10** - **F7.11**
ON	**ON**	Set 4	**F7.12** - **F7-13**

18	Switching of the frequency setting source	The **DI** digital input, in conjunction with the **F0.07** parameter setting, allows switching between two sources of frequency setting.
19	Up/Down – clearing the set value	Triggering of the input to which the code 19 function is assigned causes the current frequency value, set using the **UP** and **Down** buttons/terminals to clear and restores the initial frequency value set in parameter **F0.01**.

Code	Description	Settings	Unit	Def.	Block
20	Switching of the **START-STOP** (1) commands source	Input for switching the source of the START-STOP commands. If parameter F0.11 is set to value 1, then the input allows switching the source between the operator panel and the terminal block. If the parameter F0.12 is set to value 2, then the input allows switching the source between the operator panel and the remote control.			
21	Acceleration/deceleration lock	Command that locks the ability to change the frequency (besides the command to stop the motor).			
22	PID – Pause	Stopping the PID controller operation. The state of the controller is locked at the current level. Changes of the setpoint and the feedback signal will not affect the output of the PID controller			
23	PLC – Reset	In the PLC control mode, the „PLC – Reset" command resets the state of the PLC controller and restores it to the initial value.			
25	Counter input	Input for counting the pulses appearing at the **DI** input.			
26	Counter reset	Resetting the pulse counter (pulses are counted through the counter input – **DI** code 25).			
27	Pulse length measurement	Function that allows counting of the length of the pulses appearing at the **DI** input.			
28	Pulse length reset	Resetting the duration of the pulse counted through the pulse length measurement input (**DI** – code 27).			
29	Torque control lock	If the input is active and the inverted operated in the torque control mode, then the inverter switches to speed control mode.			
30	High-speed pulse input	The high-speed (100 kHz) pulse input function can be assigned only to input **DI5**.			
32	DC braking	Input triggering switches the inverter to DC braking mode.			
33	Alarm	Alarm input of the NC (normally closed) type. Opening of the circuit to which the Alarm function (NC) is assigned locks the inverter and reports error **Err.15**.			
34	Permission to change the frequency	If the input is triggered, then the inverter will react to commands of motor frequency change. If the input is not triggered , the frequency will be locked at the last set value.			
35	PID controller – operating direction	Input for changing the direction of the feedback in the PID control system. Please note: the default feedback direction is set with parameter **E2.03**.			
36	Braking (1)	Input for stopping the motor (in the same way as when pressing the **STOP** button on the operator panel). This function can be used for example to perform the handling of the limit switches.			
37	Switching of the **START – SOP** commands source (2)	Input for switching the source of the **START-STOP** commands between the terminal block and the remote control. If the inverter is configured for **START-STOP control** from the terminal block, then the input triggering switches the source to the remote control (and vice versa).			
38	PID – stop of the integrating controller	If the input is active, the operation of the integrating part of the PID controller is stopped, while the proportional part continues to operate normally.			
39	Switching between the main frequency source and the setpoint	Active input disconnects the main source of frequency setting and substitutes in its place the value defined in parameter **F0.01**.			
40	Switching between the auxiliary frequency source and the	Active input disconnects the auxiliary source of frequency setting and substitutes in its place the value defined in parameter **F0.01**.			

Code	Description	Settings	Unit	Def.	Block
	setpoint				
43	Switching the parameters of the PID controller	In case the PID controller is configured to switch the PID controller parameters through the terminal block (**E2.19** = 1), then: Active input – the PID controller operates according to the first set of parameters (**E2.13** – **E2.15**). Inactive input – the PID controller operates according to the second set of parameters (**E2.16** – **E2.18**).			
44	Error (1)	Input triggering locks the inverter and reports error **Err.27**. The exact behavior of the inverter operation after an error occurs can be defined in parameter **F8.19**.			
45	Error (2)	Input triggering locks the inverter and reports error **Err.28**. The exact behavior of the inverter operation after an error occurs can be defined in parameter **F8.19**.			
46	Switch between the torque control and speed control	Input for switching between the set torque control and the set speed control. If the input is inactive, the inverter is controlled according to the setting of parameter **E0.00**. If the input is active, the inverter switches to the second operating mode.			
47	Emergency braking	Input triggering causes the motor to stop as quickly as possible. The braking time is set automatically in such a way that the braking current does not exceed the maximum value and there is no emergency lock of the inverter.			
48	Braking (2)	Input triggering causes the motor to stop according to the braking time set in parameter **F7.13**. Please note: braking command works regardless of the selected mode of the **START-STOP** command setting.			
49	Decelerate and stop of the motor using DC braking.	Input triggering causes the motor to decelerate to the initial speed (F0.01), and then it stops the motor completely using DC braking.			
50	Operating time reset	Input cooperates with the control functions (set using the parameters **F7.42** – **F7.45**). Input triggering resets the current operating time counter and starts the countdown again.			
F1.10	Control from the terminal block	Two-wire control – Mode 1	0	-	0	Y
		Two-wire control – Mode 2	1			
		Three-wire control – Mode 1	2			
		Three-wire control – Mode 2	3			

Parameter F1.10 determines how the START-STOP commands set through the terminal block of the inverter are processed.

Two-wire control - Mode 1

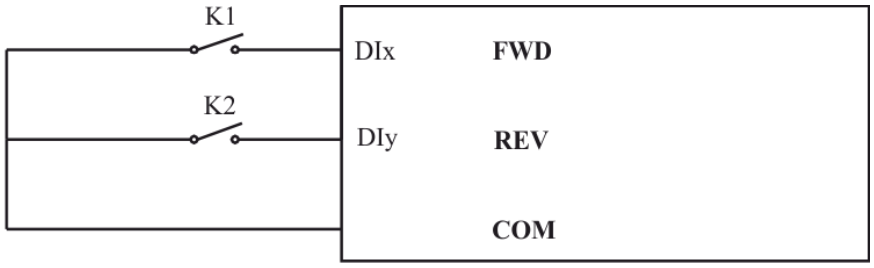
The simplest and most commonly used form of control. Two DI digital inputs have functions of forward (FWD) and reverse (REV) run.

Input configuration:

Input terminal	Setting the input configuration parameter	Function description
DIx	1	Operation – **Forward** (FWD) direction
DIy	2	Operation – **Reverse** (REV) direction

Code	Description	Settings	Unit	Def.	Block

Diagram of control connections:



Operation logic:

K1	K2	Operation
-	-	**STOP**
-	**ON**	Operation - **Reverse**
ON	-	Operation – **Forward**
ON	**ON**	**STOP**

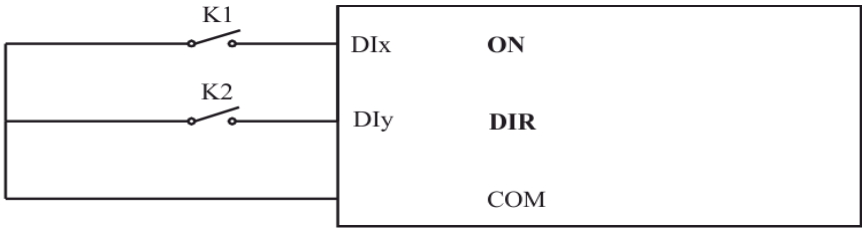
Two-wire control - Mode 2

In two-wire control mode one input (**DIx**) is used as a motor run command, and the second input (**DIy**) is used for selecting the direction of motion.

Configuration of the inputs:

Input terminal	Setting the input configuration parameter	Function description
DIx	1	Operation – **Forward** (FWD) direction
DIy	2	Operation – **Reverse** (REV) direction

Diagram of control connections:



Operation logic:

K1	K2	Operation
-	-	**STOP**
-	**ON**	STOP
ON	-	Operation – **Forward**
ON	**ON**	Operation - **Reverse**

Three-wire control - Mode 1

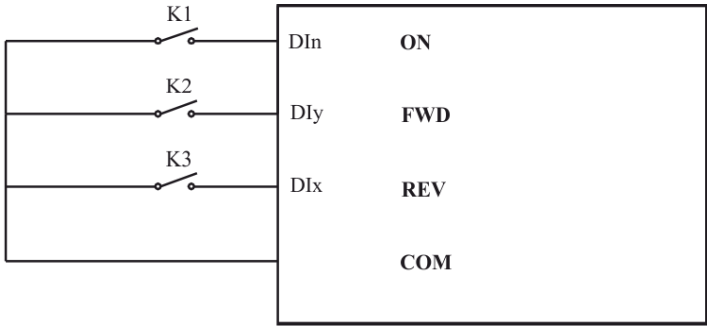
Operation permission is implemented through the activation of the **DIn** input (level control), to which the function with code 3 (three-wire control – permission to operate) is assigned. Starting the motor to operate in the preset direction is done by pressing (pulse control) **DIx** or **DIy** input to which the commands with codes 1

Code	Description	Settings	Unit	Def.	Block

and 2 are assigned accordingly. To stop the motor, deactivate the **Din** input.

Input terminal	Setting the input configuration parameter	Function description
DIy	1	Operation – **Forward** (FWD) direction
DIx	2	Operation – **Reverse** (REV) direction
DIn	3	Three-wire control – **STOP/ON**

Diagram of control connections:

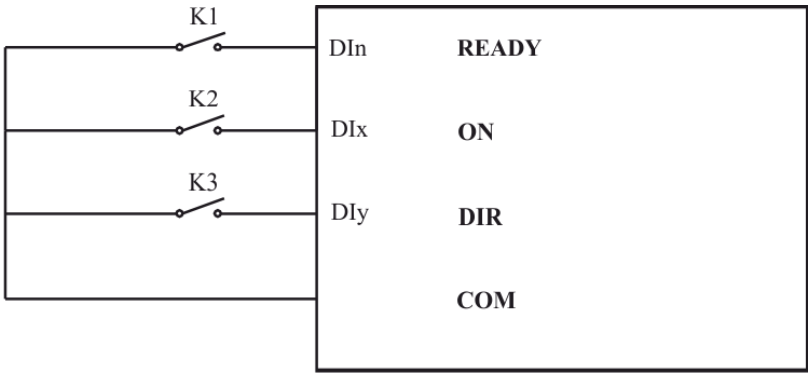


Three-wire control - Mode 2

Operation permission is implemented through the activation of the **DIn** input (level control), to which the function with code 3 (three-wire control – permission to operate) is assigned. Starting the motor is done via the **DIx** (pulse control) terminal to which the command with code 1 is assigned. Motion direction is defined through the **DIy** input (level control) to which the function with code 2 is assigned.

Input terminal	Setting the input configuration parameter	Function description
DIx	1	Operation – **Forward** (FWD) direction
DIy	2	Operation – **Reverse** (REV) direction
DIn	3	Three-wire control – **STOP/ON**

Diagram of control connections:



Code	Description	Settings	Unit	Def.	Block
Motion direction:					

DIy	Direction
0	Forward (FWD)
1	Reverse (REV)

F1.11	**UP/Down** terminal – Rate of changes	0.001 … 65.535	Hz/s	1.0	N

In case the input terminals are used for performing **UP/DOWN** functions, parameter F1.11 determines how fast the set frequency value will change.

Please note: If the parameter **F0.02** is set to value 1, the rate of changes can be set in a range of 0.01 Hz/s to 655.35 Hz/s. If the parameter **F0.02** is set to value 2, the rate of changes can be set in a range of 0.001Hz/s to 65.535 Hz/s.

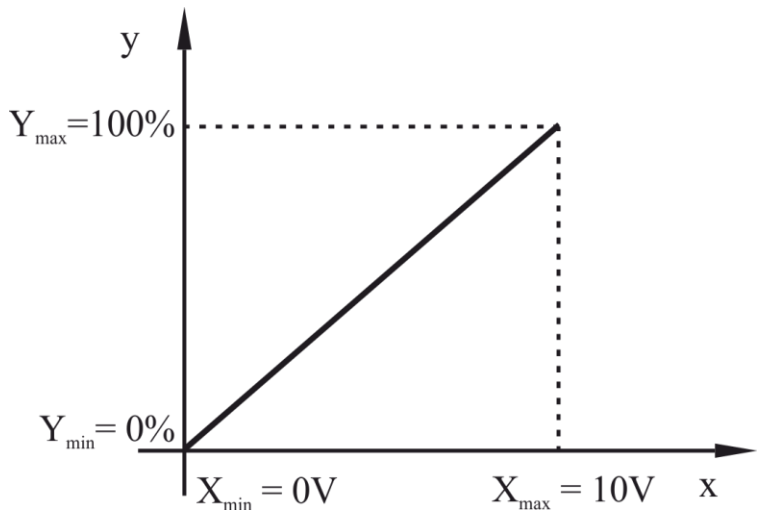
F1.12	First characteristic of analog input	X_{min}	0.00 … **F1.14**	0.00	V	N
F1.13		Y_{min}	-100.00 … 100.00	0.00	%	N
F1.14		X_{max}	F1.12 … 10.00	10.00	V	N
F1.15		Y_{max}	-100.00 … 100.0	100.00	%	N
F1.16	Second characteristic of analog input	X_{min}	0.00 … **F1.14**	0.00	V	N
F1.17		Y_{min}	-100.00 … 100.00	0.00	%	N
F1.18		X_{max}	F1.12 … 10.00	10.00	V	N
F1.19		Y_{max}	-100.00 … 100.0	100.00	%	N
F1.20	Third characteristic of analog input	X_{min}	0.00 … **F1.14**	0.00	V	N
F1.21		Y_{min}	-100.00 … 100.00	0.00	%	N
F1.22		X_{max}	**F1.12** … 10.00	10.00	V	N
F1.23		Y_{max}	-100.00 … 100.0	100.00	%	N

The FA-3X… inverter allows to define three characteristics of dependencies between the voltage (current) on the analog input and the setpoint on the output of the analog converter. Type of characteristic can be associated with a particular analog input via parameter **F1.24** (it is possible to assign both a single characteristic to several inputs, as well as set different characteristic for each input).
If the signal value on the analog input exceeds the value $\mathbf{X_{max}}$, then the value of the output signal remains at level $\mathbf{Y_{max}}$. If the value of the signal on the analog input is lower than the value $\mathbf{X_{min}}$, then value **0** or $\mathbf{Y_{min}}$ (depending on the setting of parameter **F1.25**) can be set on the output.

Some examples of characteristic settings can be found in the following table:

	Example 1 Voltage input 0-10 V set in such a way that the setpoint of 0% corresponds to the input voltage of 0-10 V, and the setpoint of 100% - voltage 10 V.

Code	Description	Settings	Unit	Def.	Block

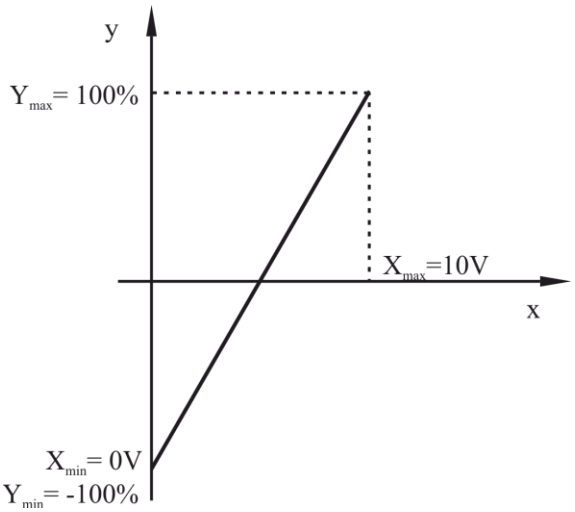


Settings:

F1.12	X_{min}	0.00 V
F1.13	Y_{min}	0.0 %
F1.14	X_{max}	10.00 V
F1.15	Y_{max}	100.0%

Example 2

Voltage input 0-10 V set in such a way that the setpoint of -100% corresponds to the input voltage of 0 V, and the setpoint of 100% - voltage 10 V. In that case, the setpoint of 0% will be achieved for the input voltage of 5 V.

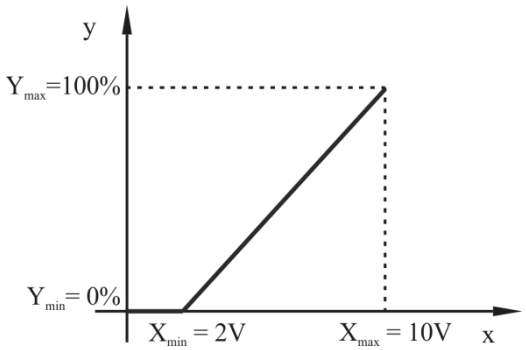


Settings:

F1.12	X_{min}	0.00 V
F1.13	Y_{min}	-100.0 %
F1.14	X_{max}	10.00 V
F1.15	Y_{max}	100.0%

<table>
<tr><th>Code</th><th>Description</th><th>Settings</th><th>Unit</th><th>Def.</th><th>Block</th></tr>
<tr><td></td><td></td><td colspan="4">
Example 3
Current input of 4-20 mA is set in such a way that for the current of 4 mA the setpoint is 0%, and for the current of 20 mA – 100%.

Please note: When using the current input, input signal is calculated according to the following dependency: 1 mA = 0.5 V.



Settings:
<table>
<tr><td>F1.12</td><td>X_{min}</td><td>2.00 V</td></tr>
<tr><td>F1.13</td><td>Y_{min}</td><td>0.0 %</td></tr>
<tr><td>F1.14</td><td>X_{max}</td><td>10.00 V</td></tr>
<tr><td>F1.15</td><td>Y_{max}</td><td>100.0%</td></tr>
</table>
</td></tr>
<tr><td>F1.24</td><td>Selection of the characteristic of the analog input</td><td colspan="2">
Units digit – selection of the characteristic for input AI1
First characteristic (F1.12 … F1.15) – 1
Second characteristic (F1.16 … F1.19) – 2
Third characteristic (F1.20 … F1.23) – 3
Tenths digit – selection of the characteristic for input AI2
Values – as above.
Hundredths digit – selection of the characteristic for the potentiometer on the operator panel
Values – as above.
</td><td>-</td><td>321</td><td>N</td></tr>
<tr><td>F1.25</td><td>Signal value below the minimum value</td><td colspan="2">
Units digit – Input AI1
Minimum value – 0
0.0% – 1
Tenths digit – Input AI2
Values – as above.
Hundredths digit – Potentiometer on the operator panel
</td><td>-</td><td>0</td><td>N</td></tr>
</table>

Code	Description	Settings		Unit	Def.	Block
		Values – as above.				

Parameter **F1.25** determines how the analog signal will be converted if its value drops below the minimum level. Two actions are possible in this scenario:

0 – Minimum value

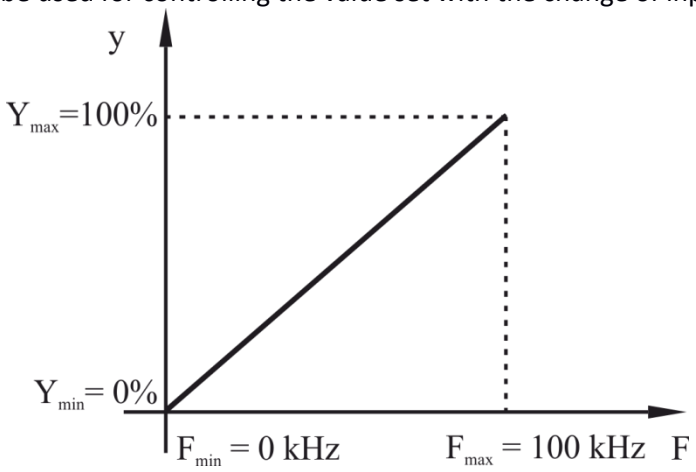
Setpoint remains set at the minimum level (according to the value of parameter Y_{min} - parameters **F1.13**, **F1.17**, **F1.21**).

1 – 0.0%

Setpoint is set to the value of 0.0%

F1.26	High-speed pulse input	F_{min}	0.00 … **F1.28**	kHz	0	N
F1.27		Y_{min}	-100.0 … 100.0	%	0	N
F1.28		F_{max}	**F1.26** … 100	kHz	50	N
F1.29		Y_{max}	-100.0 … 100.0	%	100	N

Parameters **F1.26** … **F1.29** are designated to the calibration of high-speed pulse input (connected to the **DI5** input operation). They can be used for controlling the value set with the change of input signal frequency.



F1.30	Filtering	Digital inputs **DI**	0.000 … 1.000	s	0.01	N
F1.31		Analog inputs **AI1**	0.00 … 10.00	s	0.1	N
F1.32		Analog inputs **AI2**	0.00 … 10.00	s	0.1	N
F1.33		Potentiometer on the operator panel	0.00 … 10.00	s	0.1	N
F1.34		Pulse input	0.00 … 10.00	s	0.1	N

Parameters of the group **F1.30** – **F1.34** allow specifying the length of time from which the voltages applied on the analog and digital inputs are filtered. In case of interference or quick changes of the voltage on the inputs it is recommended to extend the length of filtering time in order to avoid invalid operation of the inputs.

Please note: Extending the filtering time increases the inputs resistance to interference, but also slows down the reaction time of the inverter to the input state change.

F1.35	Inputs **DI1** … **DI5** logic	**First digit** – input **DI1**		-	0	Y
		Positive logic - Active when contact closed	0			
		Negative logic - active when	1			

Code	Description	Settings	Unit	Def.	Block
		contact open			
		Second digit – input **DI2**			
		Third digit – input **DI3**			
		Fourth digit –input **DI4**			
		Fifth digit – input **DI5**			
F1.36	Inputs **DI6** … **DI8** logic	**First digit** – input **DI6**			
		Second digit – input **DI7**			
		Third digit – input **DI8**			

Parameters **F1.35** and **F1.36** allow to determine the method of activation independently for each digital input.

0 – Positive logic

If positive logic is selected, closing of the contact between the inputs **DI** and **COM** (default) is treated as an input activation. Open contact between the inputs **DI** and **COM** is treated as an inactive input.

1 – Negative logic

If negative logic is selected, open contact between the inputs **DI** and **COM** (default) is treated as an input activation. In contrast, closed contact between the inputs **DI** and **COM** is treated as an inactive input.

F1.37	**DI1** – Delay Time	0.0 … 3600.0	s	0.0	Y
F1.38	**DI2** – Delay Time	0.0 … 3600.0	s	0.0	Y
F1.39	**DI3** – Delay Time	0.0 … 3600.0	s	0.0	Y

Time from the digital input state change to the activation of the function associated with the given digital input.

Please note: Only inputs **DI1**, **DI2**, **DI3** allow setting the delay of input activation.

Outputs functions

Code	Description	Settings		Unit	Def.	Block
F2.00	SPB output operation mode	High-speed pulse output	0	-	0	N
		Standard transistor output	1			
The **SPB** output can operate in two different modes – as a high-speed pulse output with a maximum output frequency of 100 kHz or as a classic transistor output of the OC (open collector) type. In the first case (high-speed output) the function of the output is selected using parameter **F2.06**, and in the second case (normal output) using parameter **F2.01**.						
F2.01	**SPB** transistor output function	0 … 40		-	0	N
F2.02	**T1** relay output function	0 … 40		-	2	N
F2.04	**SPA** transistor output function	0 … 40		-	1	N
F2.05	**T2** relay output function	0 … 40		-	4	N

Parameters **F2.01** … **F2.05** select the function for the digital inputs to perform: transistor SPA and SPB, and relays **T1** and **T2**. One of the forty functions described in the table below can be assigned to each of these outputs:

Value	Function	Description
0	No function	No function is assigned to the output.
1	Stand-by – frequency 0 Hz	This status is indicated when the inverter run command is issued while the output frequency is set to 0 Hz.
2	Error	Error reporting and emergency shutdown of the inverter.
3	Reaching frequency FDT1	In combination with the parameters **F7.23** and **F7.24** the output will indicate the reaching and exceeding of the setpoint. More information in the description of the **F7.23** and **F7.24** parameters.
4	Reaching the preset frequency	In conjunction with parameter F7.25 the output will indicate reaching of the set frequency and operation in a specified zone around the setpoint. More information in the description of the **F7.25** parameter.
5	Speed 0 Hz	Output is active if the frequency is set to 0 Hz.
6	Motor overload	Motor overload indication (related to parameters **F8.02** – **F8.04**)
7	Inverter overload	Output is activated when the inverter overload is detected, but for ten seconds before the emergency shutdown of the drive.
8	Pulse counter overflow	Inverter allows programming the counter (counting pulses applied on the DI input) with specified maximum value and setpoint. As soon as the setpoint is exceeded, output will be activated with code 9, and, in addition, output with code 8 will be activated after counting out the maximum value. More information in the description of the parameters **E0.08** and **E0.09**.
9	Count out the preset number of pulses	
10	Measure out of the preset length	When the digital input is used for converting the number of pulses for the length of material, then the reaching of preset length will be indicated on the digital output to which the function with code 10 is assigned.
11	End of the PLC operation cycle	The moment the full operation cycle in the PLC mode is ended, output will be activated for the duration of 250 ms.
12	Reaching the cumulative time of operation	The output is activated when the cumulative time of inverter operation (parameter **F6.07**) exceeds the preset threshold value defined in parameter **F7.21**.
13	Output frequency limit	Output is active when the preset frequency is higher than the maximum value or lower than the minimum value (which means when the

Code	Description	Settings	Unit	Def.	Block
		inverter cannot reach the preset frequency).			
14	Limit of the output torque	Output is active when the threshold value of torque is exceeded.			
15	Operation readiness	Output is activated when the inverter is ready to operate, which means when the power is on, voltage on the DC track is stable and there were no reported errors.			
16	AI1 > AI2	Output is active when the voltage level on analog input AI1 is higher than that on input AI2.			
17	Reaching the upper frequency	Output is active when the upper threshold frequency is reached or exceeded.			
18	Reaching the lower threshold frequency	Output is active when the output frequency is equal to or lower than the minimum value. **Please note**: If the inverter is stopped (STOP command), the output is inactive.			
19	Low power voltage	The output is activated when it detects an under-voltage in the DC track of the inverter.			
23	Speed 0 Hz (2)	Output is active when the output frequency is 0 Hz. **Please note**: Output is also activated when the motor is stopped with the **STOP** command.			
24	Reaching the preset cumulative time of the inverter operation	If the inverter switch-on time (parameter **F6.08**) reaches the value set in the parameter **F7.20,** then the output will be activated.			
25	Reaching frequency FDT2	Indication of reaching and exceeding the preset frequency FDT2. More information in the description of parameters **F7.26** and **F7.27**			
26	Reaching frequency f_1	Indication of reaching the frequency set in parameters **F7.28** and **F7.29**.			
27	Reaching frequency f_2	Indication of reaching the frequency set in parameters **F7.30** and **F7.31**.			
28	Reaching current I_1	Indication of reaching current I_1 with value set in parameters **F7.36** and **F7.37**.			
29	Reaching current I_2	Indication of reaching current I_2 with value set in parameters **F7.38** and **F7.39**.			
30	Reaching the current operation time	If the meter of current operation time is programmed (parameters **F7.42** – **F7.44**), then the output will be activated when the set motor operation time is reached.			
31	Exceeding the levels of voltages on the **AI1** input	Output is active when the voltage on analog input **AI1** is lower than the value set in parameter **F7.50**, or higher than the value set in parameter **F7.51**.			
32	Load decrease	Output is activated when the inverter detects decrease in motor load.			
33	Reverse run	Output is active when the motor rotates in the "**Reverse"** direction.			
34	Decrease in current load	Output is active when the value of current load decreases below the value defined in parameters **F7.32** and **F7.33**.			
35	Exceeding temperature	Output is active when the temperature of the inverter power module (parameter **F6.06**) exceeds the threshold value defined in parameter **F7.40**.			
36	Exceeding the current load	Output is active when the value of current load increases above the level defined in parameters **F7.34** and **F7.35**.			
37	Minimum frequency	Output is active when the frequency is equal to or lower than the			

Code	Description	Settings	Unit	Def.	Block
		minimal value. **Please note**: Output will also be active when the motor is stopped with the **STOP** command.			
38	Alarm	Alarm indication			
F2.06	High-speed pulse output function	0 … 15	-	0	N
F2.07	Analog output **DA1** function	0 … 15	-	0	N
F2.08	Analog output **DA2** function	0 … 15	-	1	N

High-speed pulse output can operate in the frequency range of 0.01 kHz to the value defined with parameter **F2.09** (maximum of 100 kHz). Analog outputs can operate in the range of 0 to 10 V (voltage output) or from 0 to 20 mA (current output). One of the fifteen dedicated functions can be assigned to both the pulse output and analog outputs.

Value	Function	Description
0	Current frequency	Value of the output signal is proportional to the current output frequency of the inverter. Scaling of the signal covers the range from 0 Hz to maximum output frequency.
1	Preset frequency	Value of the output signal is proportional to the preset output frequency. Scaling of the signal covers the range of 0 Hz to maximum frequency.
2	Output current	Value of the output signal is proportional to the effective value of the output current. Scaling of the signal covers the range of 0 to 200% of the motor rated current.
3	Output torque	Value of the output signal is proportional to the driving torque. Scaling of the signal covers the range of 0 to 200% of the rated torque.
4	Output power	Value of the output signal is proportional to the current output power. Scaling of the signal covers the range of 0 to 200% of the rated power.
5	Output voltage	Value of the output signal is proportional to the effective voltage value on the output of the inverter. Scaling of the signal covers the range of 0 to 120% of the rated inverter voltage.
6	High-speed pulse output	Value of the signal is proportional to the frequency of the signal applied on the high-speed pulse input **DI5**. Scaling of the signal covers the range of 0 to 100 kHz.
7	AI1	Value of the signal is proportional to the voltage value on the analog input **AI1**. Scaling of the signal covers the range of 0 to 10 V.
8	AI2	Value of the signal is proportional to the voltage value on the analog input **AI2**. Scaling of the signal covers the range of 0 to 10 V.
10	Length	In the length measurement mode the output signal is proportional to the currently measured length.

Code	Description	Settings	Unit	Def.	Block
		Scaling of the signal covers the range of zero to the preset final length (parameter **E0.05**).			
11	Counter	In the element counting mode the output signal is proportional to the counter value. Scaling of the signal covers the range of zero to the preset final value of the counter (parameter **E0.08**)			
13	Rotational speed	Output signal is proportional to the current rotational speed of the motor. Scaling of the signal covers the range of zero to the rotational speed corresponding to the maximum frequency.			
14	Output current	Output signal is proportional to the value of the output current of the inverter. Scaling of the signal covers the range of 0 to 100 A.			
15	DC voltage	Output signal is proportional to the value of DC voltage on the link circuit of the inverter. Scaling of the signal covers the range of 0 to 1000 V.			

F2.09	High-speed pulse output – maximum frequency	0.01 … 100.00	kHz	50	N

Maximum signal frequency on the high-speed pulse output SPB. Each scaling of the signal to the pulse output is done accordingly to the maximum frequency.

Example
If the maximum frequency of the pulse output **SPB** is set to the value of 50 kHz and the output is set to function 14 (output current), then:
- frequency of 0 kHz corresponds to current of 0 A (minimum value);
- frequency of 50 kHz corresponds to current of 100 A (maximum value).

F2.10	**SPB** output delay	0.0 … 3600.00	s	0	N
F2.12	**T1** relay output delay	0.0 … 3600.00	s	0	N
F2.13	**SPA** output delay	0.0 … 3600.00	s	0	N
F2.14	**T2** relay output delay	0.0 … 3600.00	s	0	N

Parameters **F2.10** – **F2.14** allow to induce delay between the occurrence of an event that triggers the binary outputs of the inverter and the moment when the state of the output will actually change.

F2.15	Binary outputs logic	First digit (xxxx**X**) – SPB output logic Positive logic: 0 Negative logic: 1 Second digit (xxx**X**x) – T1 relay output logic Fourth digit (x**X**xxx) – **SPA** output logic Fifth digit (**X**xxxx) - T2 relay output logic			

Subsequent digits of the parameter **F2.15** determine the logic of the binary outputs: transistor **SPA** and **SPB** and relays **T1** and **T2**.

0 – Positive logic

Positive logic means that if the output is active then the corresponding relay contact is closed and the transistor (operating in the OC – open collector system) is activated.

1- Negative logic

Negative logic means that if the output is active then the corresponding relay contact is open and transistor (operating in the OC – open collector system) is deactivated.

F2.16	Zero shift for the output	-100.0 … +100.00	%	0	N

Code	Description	Settings	Unit	Def.	Block
	DA1				
F2.17	**DA1** output amplification factor	-10.00 … +10.00	-	0	N
F2.18	Zero shift for the output **DA2**	-100.0 … +100.0	%	0	N
F2.19	**DA2** output amplification factor	-10.00 … +10.00	-	0	N

Parameters F2.16 – F2.18 are used for shifting and scaling the characteristic of the analog outputs **DA1** i **DA2**. Shifting zero by 100% means rising the characteristic of output signal by 10 V (or 20 mA). In this case, the rescaled value of +10 V will correspond to output value of 0 V.

Resulting value of the output signal can be calculated from the pattern **y = kX + b**, where:
k is the amplification factor;
X – input value of analog signal;
b – characteristic shift;
y – rescaled and boosted value of the output signal.

Example
Assuming that output analog signal has to represent the output frequency in such a way that frequency of 0 Hz is 8 V and the maximum frequency is 3 V, then::
k = -0.5
b = 80%

START – STOP functions

Code	Description	Settings		Unit	Def.	Block
F3.00	Starting method	Direct start-up	0	-	0	N
		Start-up with speed tracking	1			
		Start-up with initial activation	2			

Parameter F3.00 determines the method of motor starting.

0 – Direct start-up
Motor is started from the speed of 0 Hz. If the DC braking is set, then the motor stopping procedure is performed first and only then the start-up commences.

1 – Start-up with speed tracking
When the command is issued, the inverter analyzes rotational speed and direction of rotation and then performs motor start-up, starting from current engine speed.

2 – Start-up with initial activation
Starting with initial activation applies only to asynchronous motor control. It consist of initial magnetization of the motor and creation of additional activation stream. Parameters **F3.05** and **F3.06** must be set to start-up the motor with initial activation.

F3.01	Method of speed tracking	From the final speed	0	-	0	Y
		From the speed of 0 Hz	1			
		From the maximum speed	2			

The method of speed tracking determines how the inverter search for the current rotational speed of the motor. Depending on the duration of the operation break and the current motor speed, different strategies allow to achieve several times of speed identification.

0 – Start from the final speed
Tracking begins from the frequency at which the inverter has been shut down (downward towards the frequency of 0 Hz). This method allows to quickly finding the motor speed when the gaps between starts were short and the torque of the motor was low.

1 – Start from the speed of 0 Hz
Tracking begins from the frequency of 0 Hz upward. This solution works well when we are dealing with long gaps between subsequent starts.

2 – Start from the maximum speed

F3.02	Tracking speed	1 … 100	-	20	N

Operation speed of the speed tracking system. The higher the value, the faster the system operation. However, too high value may lead to a situation that the inverter can't identify the correct speed and begins the start-up from the initial speed.

F3.03	Starting frequency	0.00 … 10.00	Hz	0.00	N
F3.04	Time of operation with starting frequency	0.0 … 100.0	s	0.0	Y

The motor starts with the starting frequency **F3.03**, which is held for the time **F3.04**. The motor accelerates to the preset frequency. Time of operation with the starting frequency is not counted until the motor accelerates. In case of direction switching, the operating torque along with the starting frequency are skipped.

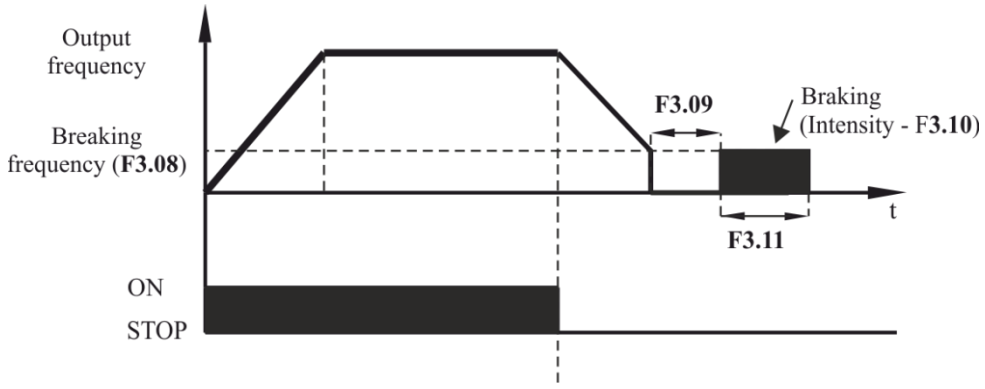
Please note: If the preset frequency is lower than the starting frequency then the phase with the starting speed will be skipped.

Example 1 – Starting frequency higher than the frequency setpoint
F0.01 = 2.00 Hz – Frequency setpoint of 2 Hz
F3.03 = 5.00 Hz – Starting frequency of 5 Hz

Code	Description	Settings	Unit	Def.	Block
		F3.04 = 2.0 s – Time of operation with the starting frequency – 2 s Since the starting frequency is higher than the setpoint frequency, so for 2 seconds from the moment the run command was issued the motor is stopped, then it accelerates to the speed of 2 Hz. **Example 2 –** Starting frequency lower than the frequency setpoint F0.01 = 10.00 Hz – Frequency setpoint of 10 Hz F3.03 = 5.00 Hz – Starting frequency of 5 Hz F3.04 = 2.0 s – Time of operation with the starting frequency – 2 s The motor accelerates to the speed of 5 Hz and maintains this speed for the time of 2 seconds, than it accelerates to the target speed of 10 Hz.			
F3.05	Motor start-up	Initial DC braking current, initial activation stream	0… 100	%	0	Y
F3.06		Initial DC braking time, initial motor activation time	0.0 … 100.0	s	0.0	Y
Parameters **F3.05** and **F3.06** are active when the option of initial motor braking with direct current prior to the actual start-up is active, or in the case of asynchronous motors, when the option to generate initial activation stream is selected. Parameter **F3.05** determines the value of braking current or activation current (the value is determines as a percentage of the nominal current of the inverter). Parameter **F3.06** determines the duration time of braking or activating.						
F3.07	Stopping method	Braking	0	-	0	N
		Coast to stop	1			
0 – Braking After receiving the motor stopping command the inverter gradually reduces the rotational speed of the motor according to the time specified in **Braking time** until it reaches 0 Hz. **1 – Coast to stop** Motor stopping command disconnects the inverter output from the driven motor. Without power, the motor coasts to stop in time resulting from its initial speed and the moment of inertia.						
		Please note In the case of the drives with large moment of inertia, the suitably long braking time should be used or the motor should be stopped with coast to stop. Otherwise there is a risk that the excess energy returned by the rapidly braking motor will be forwarded to the inverter which will cause a rapid surge of voltage on the DC track and emergency shutdown of the inverter.				
F3.08	Motor stoppi	DC braking start frequency	0.00 – F0.19 (Maximum frequency)	Hz	0	N
F3.09		Time to DC braking	0.0 … 100.0	s	0	N

Code	Description	Settings	Unit	Def.	Block
	start				
F3.10	DC braking current	0 … 100	%	0	N
F3.11	DC braking time	0.0 … 100.0	s	0	N

In the case of direct current braking the inverter will decelerate to frequency **F3.08** and disconnect the motor power. After time **F3.09** braking will start with the direct current of value **F3.10** (parameter is expressed as a percentage of a rated current of the inverter) that will last for a time **F3.11**.
Operation diagram for direct current braking is shown in the figure below.



F3.12	The effectiveness of braking module	0 … 100	%	100	N

It is used only for inverters with integrated braking unit and attached braking resistor. High efficiency allows for effective loosing of excess energy produced during intense motor braking. On the other hand, it causes the secretion of large amounts of heat on the braking resistor and large voltage variations on the DC track.

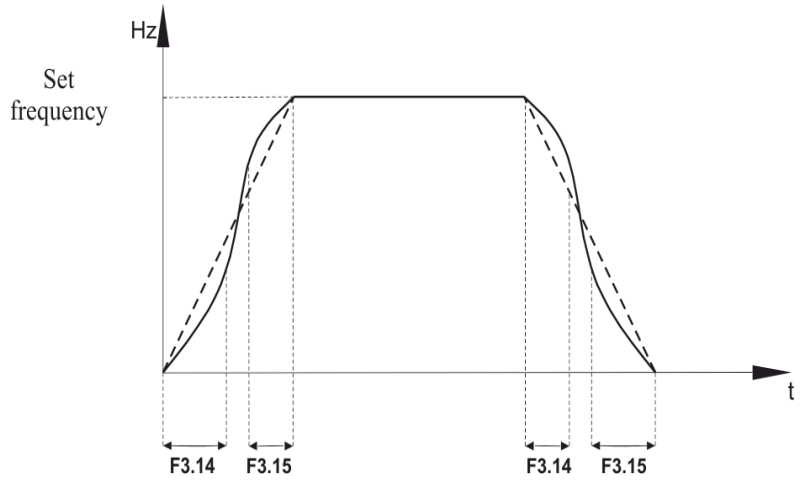
F3.13	Acceleration/deceleration characteristic	Linear characteristic	0	-	0	Y
		Acceleration/deceleration per first S curve	1			
		Acceleration/deceleration per second S curve	2			

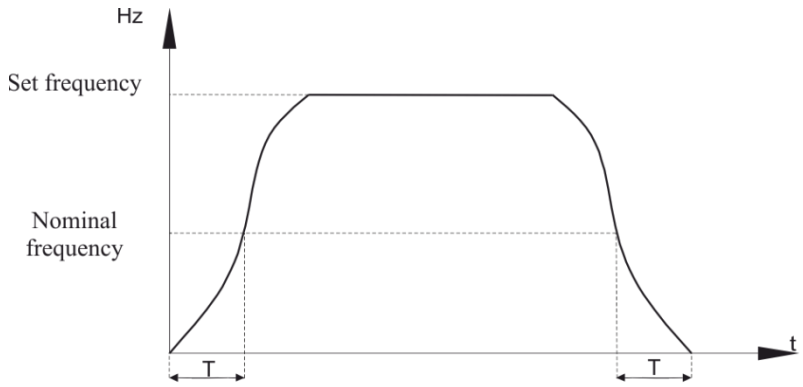
0 – Linear characteristic
The output frequency during acceleration/deceleration changes linearly from the initial value to the final value.

1 - Acceleration/deceleration per first S curve
The output frequency during acceleration/deceleration changes according to characteristic resembling letter S. This solution works well in the drives that require soft start-up without strong jolts at the start and when reaching the final value. Individual sections of acceleration curve can be set in percentages using the parameters F3.14 and F3.15.

2 – Acceleration/deceleration per second S curve
The output frequency during acceleration/deceleration changes according to characteristic resembling letter S, but unlike the previous case, the inflection point always corresponds to the rated frequency of the motor. This solution is applicable in cases where it is necessary to achieve for example such frequency ranges that are subject to different times of acceleration.

F3.14	Acceleration time per first section of the S curve	0 … 100	%	30	Y
F3.15	Acceleration time per second section of the S curve	0 … 100	%	30	Y





Acceleration/deceleration characteristic per second S curve

Parameters F3.14 and F3.15 are responsible accordingly for the sections of the characteristic where the acceleration is lower than zero (concave characteristic). Parameters F3.14 and F3.15 must have a total value lower or equal to a 100%.
If F3.14 + F3.15 < 100% then it means that in the middle of the characteristic is a section where the frequency changes in a linear fashion.

U/f characteristic

F4 parameters group is responsible for the form of the U/f characteristic. When using vector control function, settings of these parameters are ignored. U/f function control is particularly useful when the inverter is used for driving pumps, fans, simultaneous control of multiple motors or in case where there are large discrepancies between the power of the inverter and the power of the motor.

Code	Description	Settings		Unit	Def.	Block
F4.00	U/f control characteristic	Linear – U/f = constant	0	-	0	Y
		User-defined	1			
		Quadratic – $U \sim f^2$	2			
		Reduced 1 - $U \sim f^{1.2}$	3			
		Reduced 2 - $U \sim f^{1.4}$	4			
		Reduced 3 - $U \sim f^{1.6}$	6			
		Reduced 4 - $U \sim f^{1.8}$	8			
		Voltage independent of frequency	10			
		Voltage partially independent of frequency	11			

0 – Linear characteristic
Voltage on the output of the inverter rises in a linear fashion along with the rise of frequency. Linear characteristic is used in most drives with constant torque.

1 – User-defined characteristic
The dependence between the output voltage and the frequency can be freely set by the user through a three-point characteristic configured with parameters **F4.03** – **F4.08**.

2 – Quadratic characteristic
Voltage on the output of the inverter (and therefore the driving torque) rises to the square of output frequency. This characteristic is particularly applicable to the control of pumps and fans.

3 – 8 – Reduced characteristics with varying degree of U/f
Intermediate characteristics between the linear one and the quadratic dependency between the output voltage and frequency.

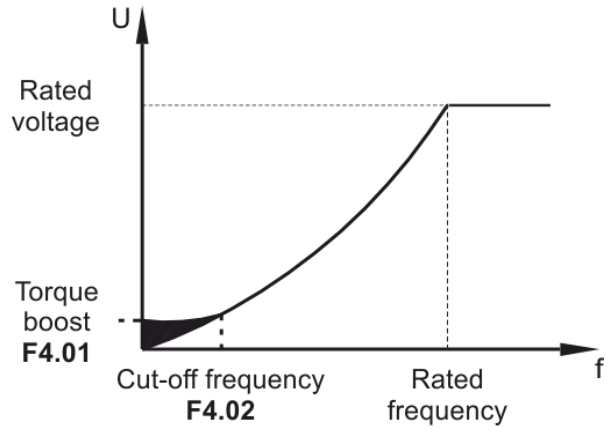
10 – Voltage independent of frequency
Voltage on the output of the inverter is fully independent of the output frequency. The frequency value is determined by the source of frequency setting, while the value of output voltage – by the setting of parameter **F4.12**.

11 – Voltage partially independent of frequency
Output voltage is related to the output frequency by a proportionality factor defined in parameter **F4.12**. This feature allows to dynamically influencing the form of control characteristic.

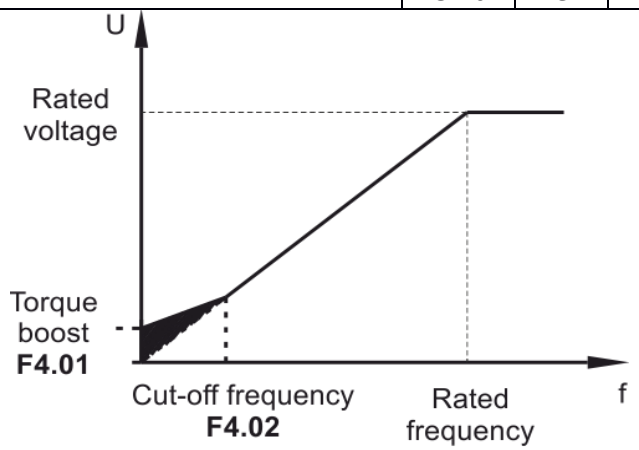
F4.01	Initial torque rise	0.0 – Automatic torque rise 0.1 … 30.0	%	4	Y
F4.02	Threshold frequency of torque boost	0.00 … Maximum frequency (**F0.19**)	Hz	15	Y

Torque boost is mainly used for improving the characteristic of torque at low frequencies under the control of the set U/f characteristic. Too low driving torque makes the motor „weak” at low speeds. Too big boost of torque can on the other hand activate motor too hard, overload the motor windings and reduce the motor efficiency.

Code	Description	Settings	Unit	Def.	Block



Reduced torque characteristic

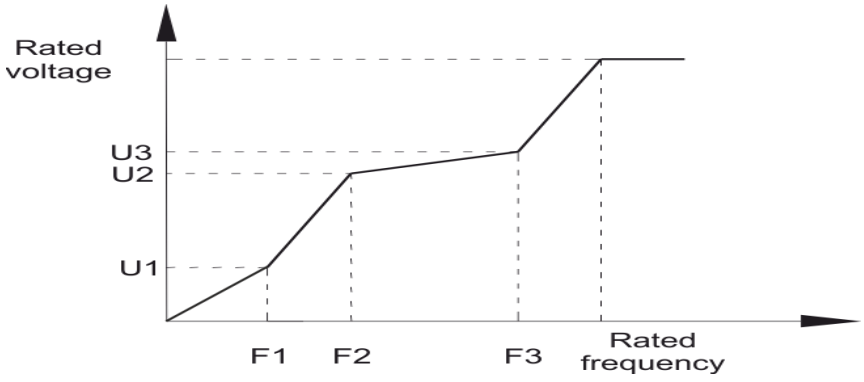


Constant torque characteristic

It is recommended to use a greater torque boost for heavy drives, where the standard driving torque is insufficient to accelerate the motor.
If the automatic boost of torque is set (**F4.01** = 0.0) the inverter will try to automatically select the necessary value of torque rise based on the rotor resistance.

F4.03	U/f user characteristic	Point 1 Frequency F1	0.00 … **F4.05**	Hz	0	Y
F4.04		Point 1 Voltage U1	0.0 … 100.0	%	0	Y
F4.05		Point 2 Frequency F2	**F4.03** … **F4.07**	Hz	0	Y
F4.06		Point 2 Voltage U2	0.0 … 100.0	%	0	Y
F4.07		Point 3 Frequency F3	**F4.07** … **b0.04** (rated frequency of the motor)	Hz	0	Y
F4.08		Point 3 Voltage U3	0.0 … 100.0	%	0	Y

Parameters F4.03 – F4.08 allow defining your own characteristic of control, best suited for the particular motor and load characteristic.



When programming the U/f characteristic keep the following relations between voltages and frequencies: **V1** < **V2** < **V3** and **F1** < **F2** < **F3**

Please note
Use caution when setting a high voltage value corresponding to a low output frequency. At low frequencies the motor windings have significantly lower

Code	Description	Settings	Unit	Def.	Block
		impedance than at the output frequency, which along with the high voltage can cause overheating of the windings or overload of the inverter.			
F4.09	Sliding compensation	0.0 … 200.0	%	0	N
Sliding compensation works correctly only with the control of the asynchronous motors in scalar U/f mode. It allows adjusting the motor speed when the load causes the sliding to increase and decreases the actual speed in relation to the setpoint. To correct the sliding compensation it is necessary to enter the proper parameters of the motor (group **b0)**, mainly parameter **b0.05** (rated rotational speed) and **b0.03** (rated current). Setting parameter **F4.09** to a value of **100%** means that the level of sliding compensation will be equal to the value resulting from the set motor parameters.					
F4.10	Counter-activation stream during braking	0.0 … 200.0	-	64	N
Motor braking may lead to a situation when the excess of energy returned by the motor may cause a rapid surge of voltage on the DC track. Activation control during braking allows reducing the voltage rise and reduces the risk of inverter locking. The higher the value of parameter **F4.10** the stronger the impact on the braking, but too high value of parameter **F4.10** leads to large currents generation. When the low inertia drive is the load of the inverter or when additional braking resistors are in use, it is recommended to set the value of parameter **F4.10** to zero.					
F4.11	Oscillation suppressing	0 … 100	-	0	N
The motor rotational speed oscillation may sometimes occur if the scalar U/f control is used. In that case parameter **F4.11** setting needs to be experimentally found and set in such a way as to eliminate oscillations. If the oscillations weren't noticed during the motor operation, it is recommended to set the **F4.11** value to zero (**F4.11 = 0**).					
F4.12	Separated U/f characteristic – voltage setting	Parameter **F4.13** setting: 0 Analog input **AI1**: 1 Analog input **AI2**: 2 Potentiometer on the operator panel: 3 High-speed pulse input (**DI5**): 4 PLC control: 6 PID controller: 7	-	0	N
If the U/f characteristic control is set to output voltage independence of frequency (**F4.00** = 10) then parameter **F4.12** decide based on what source is set the value of output voltage. Rated output voltage of the motor corresponds to the setting signal value of 100%.					
F4.13	Separated U/f characteristic – voltage setpoint	0 … Rated motor current	V	0	N
Output voltage setpoint if the voltage is independent of the frequency(**F4.00** = 0) in the U/f control mode and value of parameter F4.13 set as a source of voltage setting (**F4.12** = 0).					
F4.14	Separated U/f characteristic – time of voltage increasing	0.0 … 1000.0	s	0	N
If the value of output voltage in the U/f control mode is independent of the frequency (**F4.00** = 0), then parameter **F4.14** defines the speed of output voltage increasing when the RUN command is issued.					

Vector control

F5 parameters group is active only when the operating mode with vector control (parameter **F0.00** = 0 or 1) is active. For proper operation in vector control mode it is necessary to properly specify the motor parameters (**b0** parameters group) and identify its electrical parameters.

Please note

In most cases there is no need to modify parameters from **F5** group. Changes are justified only in cases when the standard settings of vector control do not provide satisfactory results and require extensive knowledge of control systems.

Code	Description		Settings		Unit	Def.	Block
F5.00	Controller of low speeds	Proportional part strengthening	1 … 100		-	30	N
F5.01		Integrating part doubling time	0.01 … 10.00		S	0.5	N
F5.02		Threshold frequency	0.00 … **F5.05**		Hz	5	N
F5.03	Controller of high speeds	Proportional part strengthening	1 … 100		-	30	N
F5.04		Integrating part strengthening	0.01 … 10.00		S	0.5	N
F5.05		Threshold frequency	**F5.02** … **F0.19** (maximum frequency)		Hz	5	N
Parameters **F5.00** - **F5.05** define the operation of speed controllers in vector control mode.							
F5.07	Torque limit in speed control mode		**F5.08** parameter value	0	0		
			Analog input **AI1**	1			
			Analog input **AI2**	2			
			Potentiometer on the operator panel	3			
			High-speed pulse input **DI5**	4			
			The smaller one of the values on the analog inputs **AI1** and **AI2.**	6			
			The greater one of the values on the analog inputs **AI1** and **AI2**	7			
F5.08	Upper torque limit in the speed control mode		0.0 … 200		%	150	N
For operation in the speed control mode using vector control, parameter **F5.07** determines the source from which the upper value of torque is set. If the limit is set using analog input or high-speed pulse input then the value of the torque set in parameter **F5.08** corresponds to the input value of 100%.							

F5.09	Differential strengthening	50 … 200	%	150	N
In vector control mode parameter **F5.09** can be used for improving the stability of speed. If the rotational speed is low, the stability can be improved by increasing the value of the parameter. If the rotational speed is high, reducing the value of parameter **F5.09** gives better results.					
F5.10	Time constant of the speed filter	0.000 … 0.100	s	0	N
F5.11	Counter-activation stream during braking	0 … 200	-	64	N
Motor braking may lead to a situation when the excess of energy returned by the motor may cause a rapid surge of voltage on the DC track. Activation control during braking allows reducing the voltage rise and reduces the risk of inverter locking. The higher the value of parameter **F5.11** the stronger the impact on the braking, but too high value of parameter **F5.11** leads to large currents generation. When the low inertia drive is the load of the inverter or when additional braking resistors are in use, it is recommended to set the value of parameter **F4.10** to zero.					
F5.12	Activation controller – proportional part strengthening	0 … 60000	-	2000	N
F5.13	Activation controller – integrating part strengthening	0 … 60000	-	1300	N
F5.14	Torque controller – proportional part strengthening	0 … 60000	-	2000	N
F5.15	Torque controller – integrating part strengthening		-	1300	N

Please note

Parameters characterizing controllers represent the strengthening factor with proportional and integrating part of the controller. In case of integrating part that means the high value of integrating part strengthening means stronger operation of the controller integrating part.

Operator panel

F6 parameters group is responsible for operator panel operation and organization of the data displayed on the LCD monitor.

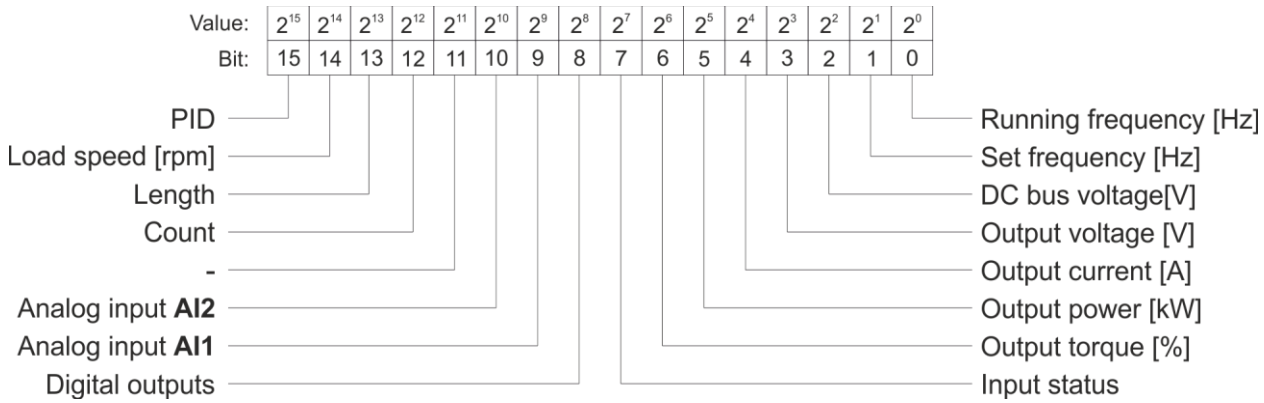
Code	Description	Settings		Unit	Def.	Block
F6.00	**STOP/RESET** button	Active only when the control is carried out through the panel	0	-	1	N
		Always active	1			

0 – Active only when the control is carried out through the panel
STOP/RESET button on the operator panel will be active only if the inverter is controlled through the operator panel.

1 – Always active
STOP/RESET button on the operator panel will always be active, no matter what control method is selected (default and recommended setting).

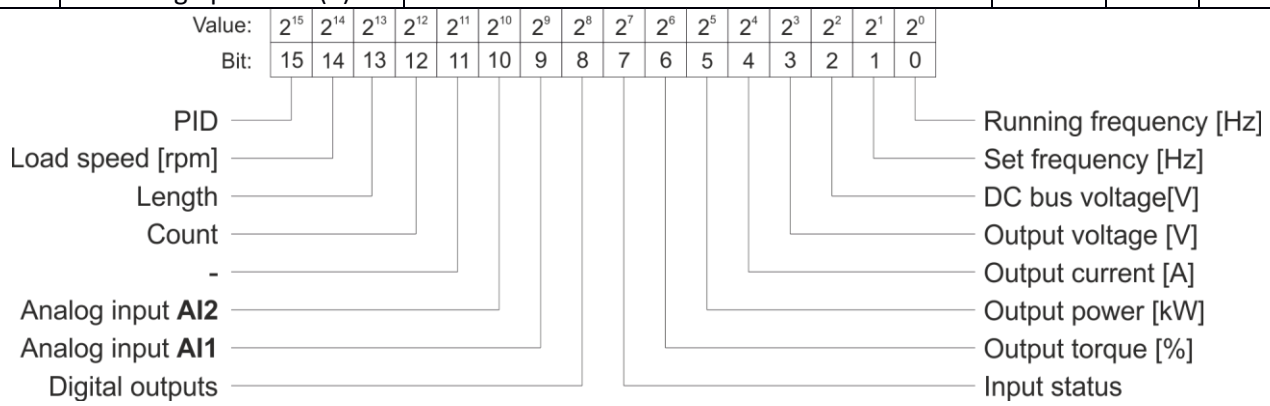
F6.01	Parameters displayed during operation (1)	0x0000 … 0xFFFF	-	0x1F	N

Parameters **F6.01** and **F6.02** have implemented set of values that will be displayed during the drive operation.



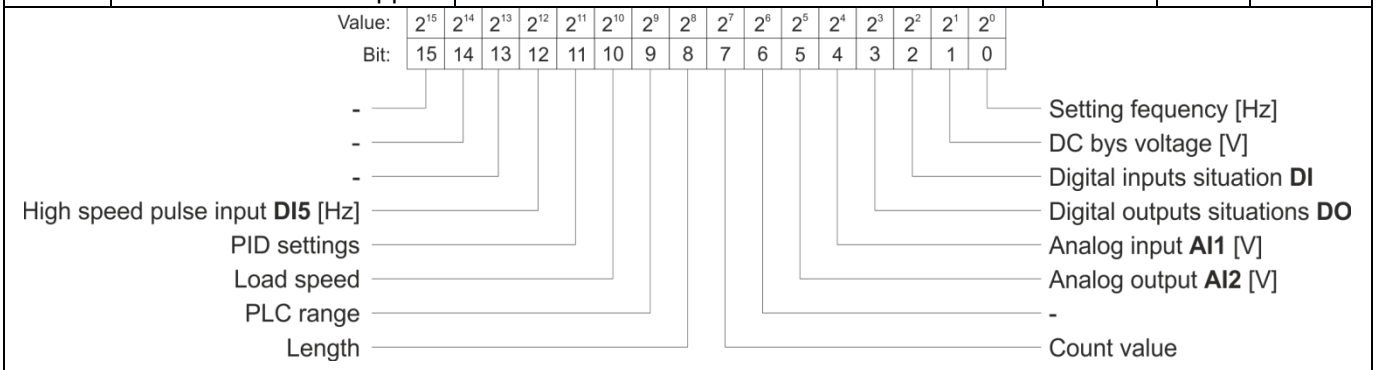
If any of the above parameters should be displayed during the drive operation, then 1 need to be set in the bit field corresponding to this parameter and then the whole number needs to be converted into a hexadecimal number (HEX) and in that form saved in parameter **F6.01**.

F6.02	Parameters displayed during operation (2)	0x0000 … 0xFFFF	-	0x0	N



If any of the above parameters should be displayed during the drive operation, then 1 need to be set in the bit field corresponding to this parameter and then the whole number needs to be converted into a hexadecimal number (HEX) and in that form saved in parameter **F6.02**.

Code	Description	Settings	Unit	Def.	Block
F6.03	Parameters displayed when the drive is stopped	0x0000 … 0xFFFF	-	0x33	N



If any of the above parameters should be displayed when the motor is stopped, then 1 needs to be set in the bit field corresponding to this parameter and then the whole number needs to be converted into a hexadecimal number (HEX) and in that form saved in parameter **F6.03**.

Please note: Parameter **Rotational speed** with the motor stopped will be showing the value calculated based on the preset frequency value.

F6.04	Rotational speed scaling	0.0001 … 6.5000	-	1	N

Parameter used for converting the current output frequency to the value displayed as the Rotational speed on the LCD monitor..

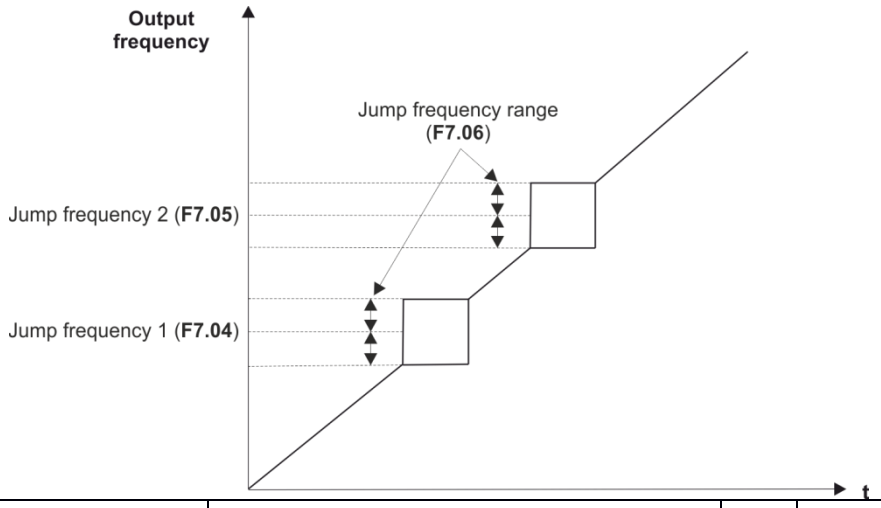
F6.05	Rotational speed – number of fractional digits	Without fractional digits	0	-	0	N
		One fractional digit	1			
		Two fractional digits	2			
		Three fractional digits	3			

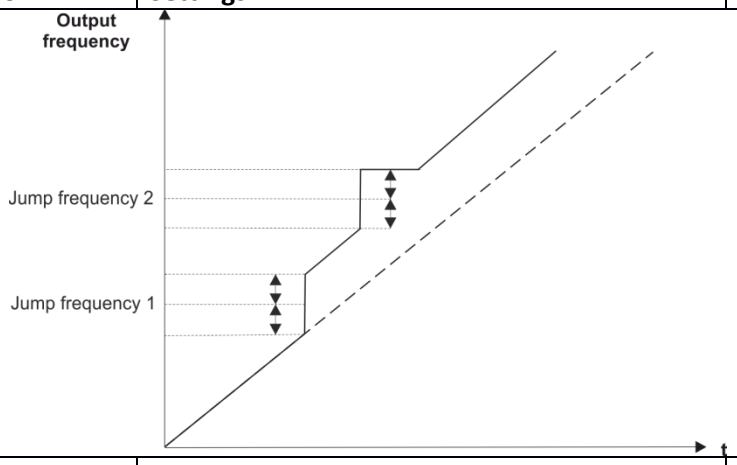
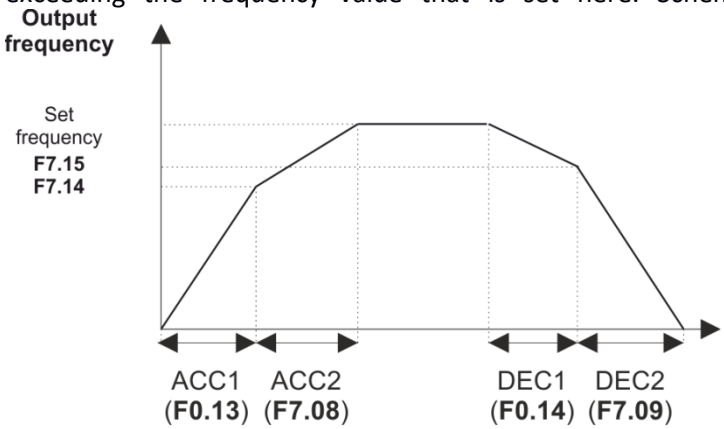
The accuracy of **Rotational speed** parameter display.

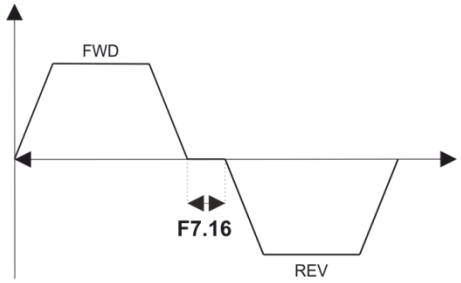
Example
If **F6.05** = 2 (two fractional digits), **F6.04** = 2.500 than the speed 40 * 2.5 = 100 will correspond to the output frequency of 40 Hz. Value 100.00 will be displayed on the monitor, because the result is to be displayed with an accuracy of two digits.

F6.06	Inverter power module temperature	0.0 … 100.0	°C	-	N
F6.07	Total operation time	0 … 65535	h.	-	N
F6.08	Total time of inverter switch-on	0 … 65535	h.	-	N
F6.09	Total power consumption	0 … 65535	kWh	-	N

Auxiliary parameters

Code	Description	Settings		Unit	Def.	Block
F7.00	JOG – Frequency	0.00 … **F0.19** (maximum frequency)		Hz	2	N
F7.01	JOG – Acceleration time	0.0 … 6500.0		s	20	N
F7.02	JOG – Braking time	0.0 … 6500.0		s	20	N
Parameters **F7.01** – **F7.03** define the behavior of the inverter during the trial run of the motor (JOG). In the Jog mode the motor is always started in direct start-up mode (**F3.00** = 0), and stopping is done via motor braking (**F3.07** = 0).						
F7.03	JOG – Operation priority	On	0	-	0	N
		Off	1			
If **F7.03** = 1, then if the JOG command is applied on the terminal block of the inverter, it will have priority over normal operation. If **F7.03** = 0, then in the case of simultaneous commands Run and JOG the Run command will be carried out.						
F7.04	Forbidden frequency 1	0.00 … **F0.19** (Maximum frequency)		Hz	0	N
F7.05	Forbidden frequency 2	0.00 … **F0.19** (Maximum frequency)		Hz	0	N
F7.06	Width of the forbidden zone	0.00 … F0.19 (Maximum frequency)		Hz	0	N
User can define two forbidden zones of operation, that is to say such frequency values that will not be possible to reach during the inverter operation. This solution is especially useful when in the range of working frequencies are resonant frequencies that induce vibrations in the drive. Scheme of operation is shown in the figure below. 						
F7.07	Skip of forbidden frequency during acceleration and braking	On	0	-	0	N
		Off	1			
If **F7.07 = 0** then during acceleration and braking of the motor the output frequency will be able to pass through the zones of forbidden frequency (smooth change of frequency). If F7.07 = 1 then during start-up and braking the zones of forbidden frequency will be skipped, which also means that there will be a rapid frequency surge on the border of forbidden zone. Operation scheme for both cases is shown in the figure below. Continuous line marks the progress of the start-up with forbidden frequencies skipped, and dotted line marks the progress of the start-up with frequency passing through forbidden frequencies.						

Code	Description	Settings	Unit	Def.	Block
					
F7.08	Acceleration time – 2	0.0 … 6500	s	-	N
F7.09	Braking time – 2	0.0 … 6500	s	-	N
F7.10	Acceleration time – 3	0.0 … 6500	s	-	N
F7.11	Braking time – 3	0.0 … 6500	s	-	N
F7.12	Acceleration time – 4	0.0 … 6500	s	-	N
F7.13	Braking time - 4	0.0 … 6500	s	-	N
FA-3X inverter has four sets of acceleration and braking times that are define in the parameters **F0.13**/**F0.14** and **F7.08** – **F7.13**. Switching between all sets can be performed using appropriate software for DI digital inputs (function codes 16 and 17). Automatic switching between the first and second time sets can be made even after exceeding the frequency setpoint (parameters **F7.14** and **F7.15**).					
F7.14	Frequency of switching between first and second acceleration time	0.00 … **F0.19** (Maximum frequency)	Hz	0	N
F7.15	Frequency of switching between first and second braking time	0.00 … **F0.19** (Maximum frequency)	Hz	0	N
Functions **F7.14** and **F7.15** are active if at the same time is not used the switching of acceleration/braking time sets from the terminal block. They allow automatic switching between the first and the second time set after exceeding the frequency value that is set here. Scheme of operation is shown in the figure below.  Acceleration – if the frequency is lower than the value **F7.14** then the acceleration is carried out according to the time **F0.13** (first acceleration time). After crossing the frequency **F7.14** the acceleration time switches to value **F7.08** (second acceleration time). Braking – if the frequency is higher than the value **F7.15** then the braking is carried out according to the time **F0.1r** (first braking time). After crossing the frequency **F7.15** the braking time switches to value				

Code	Description	Settings		Unit	Def.	Block
	F7.09 (second braking time).					
F7.16	Interval after motor stopping	0.00 … 3600.00		s	0	N
Interval between the operations in opposite directions. If, for example, the motor stops after operating **Forward**, then the switching to operate in **Reverse** will take place only after time b from the moment the motor stops. 						
F7.17	Motor operation in both direction	Allowed	0	-	0	N
		Forbidden	1			
For some drives the operation of the motor in the direction opposite to the rated direction may damage the drive. In this case the inverter can be protected from the option to operate in the direction **Reverse** by setting the parameter **F7.17** = 1.						
F7.18	Operation with frequency lower than minimum	Operation with minimum frequency	0	-	0	N
		STOP	1			
		Operation with frequency of 0 Hz	2			
If the frequency setpoint is lower than the allowable minimum value, the inverter allows you to select one of the three methods of proceeding: **0 – Operation with minimum frequency** Output frequency is set at minimum level. **1 – STOP** Motor is stopped and the output frequency is disconnected. **2 – Operation with frequency of 0 Hz** Motor is decelerated to 0 Hz, but the power supply of the motor is not disconnected (which means that the inverter can act as an electric brake).						
F7.20	Inverter switch-on setpoint time	0 … 36000		h.	0	N
Parameter for setting, for example, alarm associated with exceeding a preset time of the inverter activation. If the total operation time (parameter **F6.08**) exceeds the value set in parameter **F7.20** then the **DO** output (for which the function with code 24 was set) will be activated.						
F7.21	Preset time of drive operation	0 … 36000		h.	0	N
If the total operation time (parameter **F6.07**) exceeds the value set in parameter **F7.21** then the **DO** output (for which the function with code 12 was set) will be activated.						
F7.22	**START** command protection	On	0	-	0	N
		Off	1			
Securing the START command allows to block the possibility of unwanted automatic start when the power supply is lost and restored. **0 – Protection off** If the START command is applied on the terminal block when the power supply is switched on, the motor will be started automatically without the need for additional operations from the maintenance staff.						

Code	Description	Settings	Unit	Def.	Block

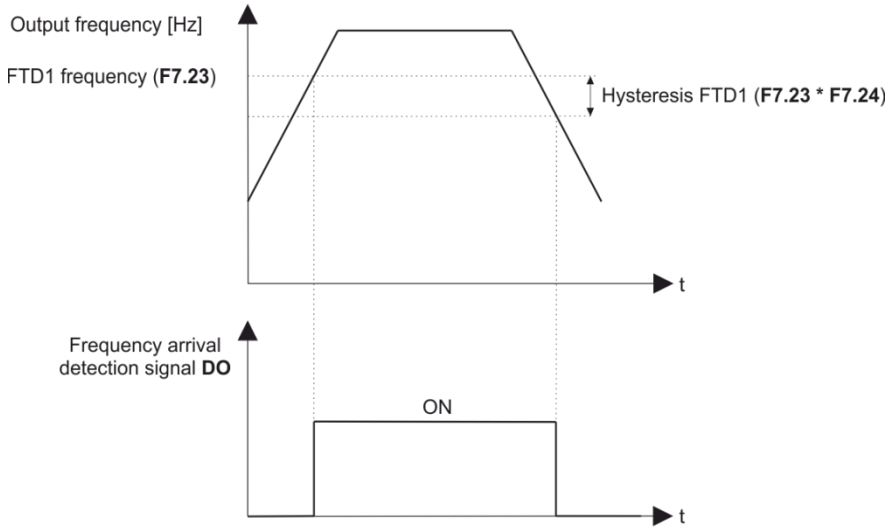
Please note:
Be extremely careful when operating the drive in which the protection of the START command is disabled. Always keep in mind that sudden power restoration and automatic start of the motor can pose a big threat for the maintenance staff.

1 – Protection on

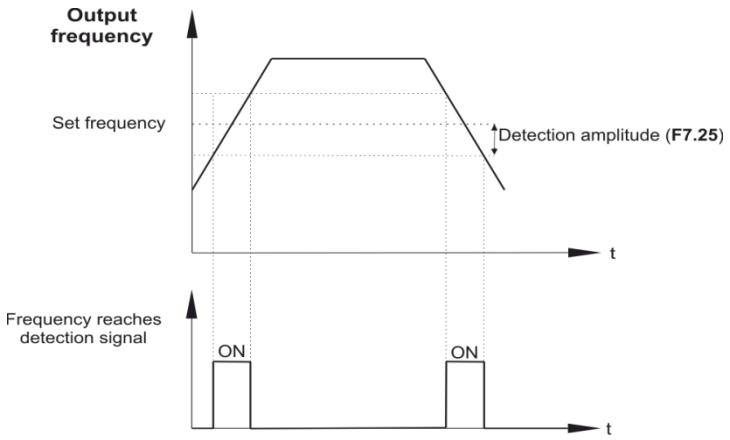
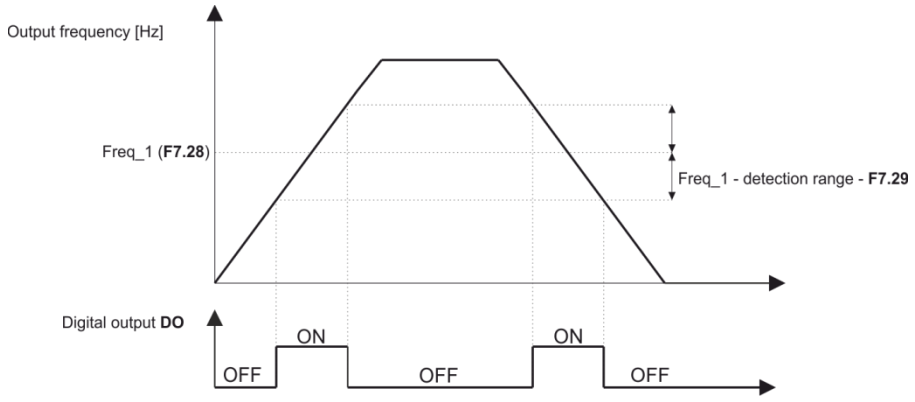
Enabling the protection means that if the START command is applied on the terminal block of the inverter when the motor is switched on, it will not automatically start the motor. First the START signal must be deactivated and the activated again to perform start-up.

F7.23	**FTD1** frequency exceeding	0.00 … F0.19 (Maximum frequency)	Hz	50	N
F7.24	**FTD1** zone hysteresis	0.0 … 100.0	%	4	N

Exceeding the set **FTD1** frequency will activate digital output **DO** to which the function with code 3 is assigned. If the frequency drops below the **FTD1** frequency and the hysteresis zone setpoint, then the output will be switched off. Scheme of function operation is shown in the figure below:

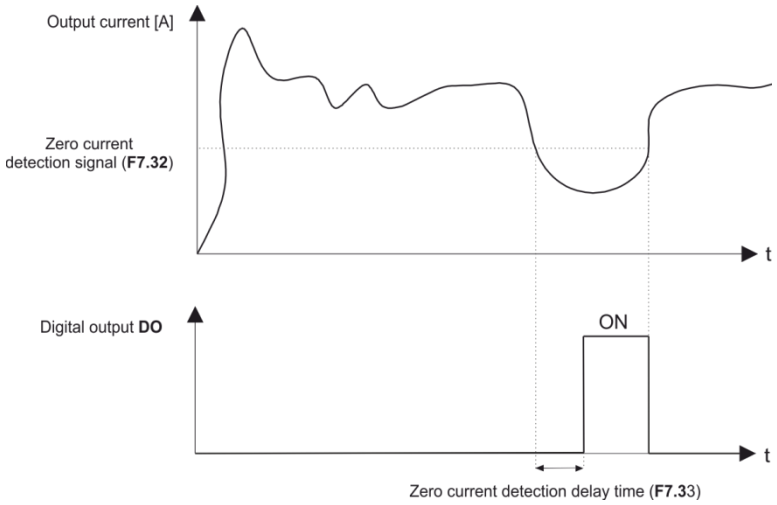


F7.25	Preset frequency zone	0.00 … 100.00	%	0	N

Code	Description	Settings	Unit	Def.	Block
If the output frequency of the inverter is in the zone (with the width specified in parameter **F7.25**) around the preset frequency then the digital output to which the function with code 4 is assigned will be activated. Parameter **F7.25** is scaled from zero to 100% of the maximum frequency. Scheme of operation is shown in the figure below:  					
F7.26	**FTD2** frequency exceeding	0.00 … F0.19 (Maximum frequency)	Hz	50	N
F7.27	**FTD2** zone hysteresis	0.0 … 100.0 (Maximum frequency)	%	4	N
Operation of parameters **F7.26** and **F7.27** is identical to the parameters **F7.23** and **F7.24**. The difference is that in this case the digital output to which function with code 25 is assigned is activated.					
F7.28	Freq_1 – Reaching frequency	0.00 … F0.19 (Maximum frequency)	Hz	50	N
F7.29	Freq_1 – Detection zone	0.0 … 100.0 (Maximum frequency)	%	0	
F7.30	Freq_2 – Reaching frequency	0.00 … F0.19 (Maximum frequency)	Hz	50	N
F7.31	Freq_2 – Detection zone	0.0 … 100.0 (Maximum frequency)	%	0	
Parameters **F7.29** – **F7.31** allow to define two zones, the reaching of which will be indicated on the digital outputs **DO**. Digital output to which the function with code 26 is assigned will be activated in the case of frequency Freq_1, and in the case of frequency Freq_2 – output with code 27 function assigned to it. Scheme of operation is shown in the figure below (operation for Freq_2 is similar).  					
F7.32	Minimum current – detection level	0.0 … 300.0 (Rated motor current)	%	5	N
F7.33	Minimum current –	0.01 … 360.00	s	0.1	N

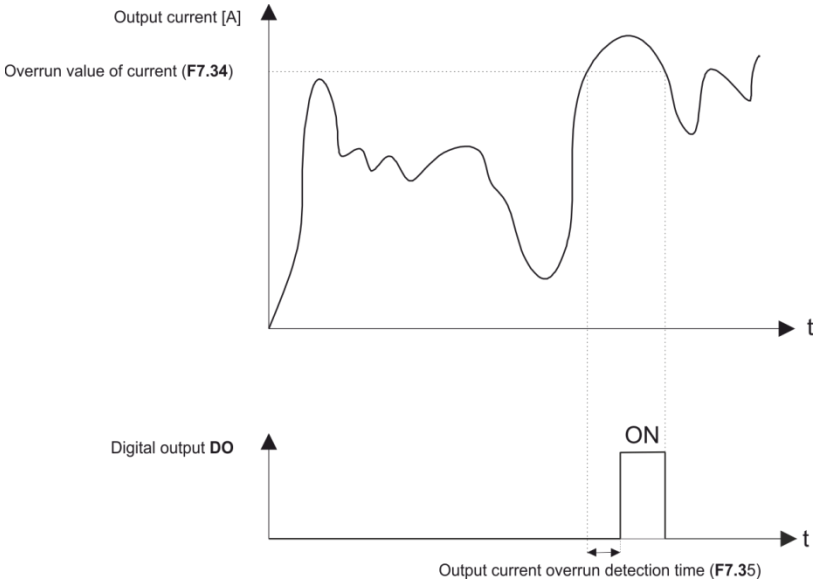
Code	Description	Settings	Unit	Def.	Block
	detection delay				

When the output current of the motor will drop during the motor operation for the preset time (parameter **F7.33**) below the minimum value (parameter **F7.32**) then the digital output to which the function with code 34 is assigned will be activated. Scheme of operation is shown in the figure below:



F7.34	Maximum current – detection level	0.0 … 300.0 (Rated motor current)	%	200	N
F7.35	Maximum current – detection delay	0.01 … 360.00	s	0.1	N

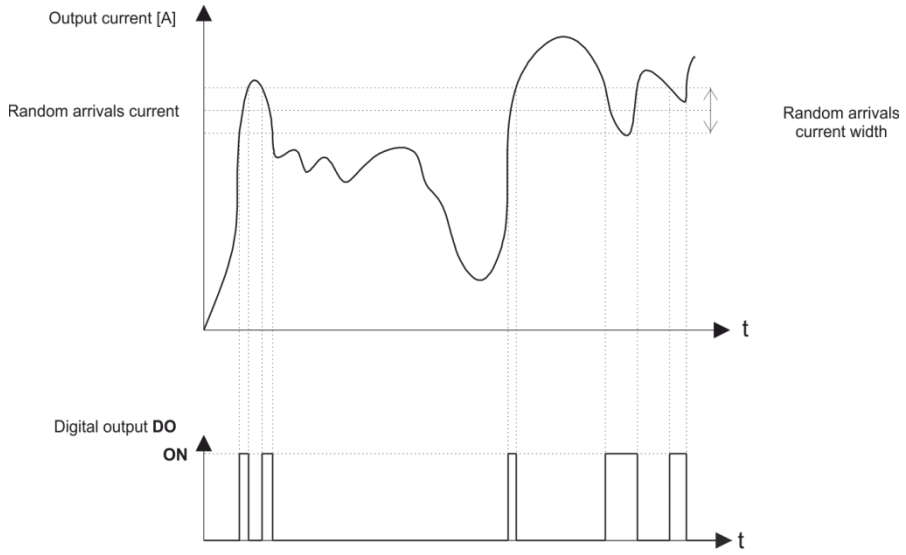
When the output current of the motor will rise during the motor operation for the preset time (parameter **F7.35**) above the maximum value (parameter **F7.34**) then the digital output to which the function with code 36 is assigned will be activated. Scheme of operation is shown in the figure below:



F7.36	Current I1 – detection level	0.0 … 300.0 (Rated motor current)	%	100	N
F7.37	Current I1 – detection zone width	0.0 … 300.0 (Rated motor current)	%	0	N
F7.38	Current I1 – detection level	0.0 … 300.0 (Rated motor current)	%	100	N

Code	Description	Settings	Unit	Def.	Block
F7.39	Current I1 – detection zone width	0.0 … 300.0 (Rated motor current)	%	0	N

Parameters **F7.36** – **F7.39** allow to define two zones, the reaching of which will be indicated on the digital outputs **DO**. Digital output to which the function with code 28 is assigned will be activated in the case of current **I1**, and in the case of current **I2** – output with code 29 function assigned to it. Scheme of operation is shown in the figure below:



Code	Description	Settings	Unit	Def.	Block
F7.40	Threshold temperature	0 … 100	°C	75	N

If the module temperature exceeds the value set in parameter **F7.40** then the digital output to which function with code 35 is assigned will be activated.

Code	Description	Settings		Unit	Def.	Block
F7.41	Fan control	Fan on during operation	0	-	0	N
		Fan always off	1			

0 – Fan on during operation

Cooling fan of the inverter switches on during the operation of the drive. When the drive is stopped the fan will be switched on if the temperature of the module exceeds 40°C.

1 – Fan always off

Cooling fan of the inverter is always on.

Code	Description	Settings		Unit	Def.	Block
F7.42	Time control	Off	0	-	0	N
		On	1			
F7.43	Method of operation time setting	Parameter **F7.44**	0			
		Analog input **AI1**	1			
		Analog input **AI2**	2			
		Potentiometer on the operator panel	3			

100% of the value set on the analog input corresponds to a value of 100% of the value of the parameter **F7.44**.

Code	Description	Settings	Unit	Def.	Block
F7.44	Operation time	0.0 … 6500.0	min.	0	N

Parameters **F7.42** – **F7.44** allow switching the inverter for a preset period of time. If parameter **F7.42** = 1 (time control is on) then the drive switches for the time set in parameters **F7.42** – **F7.43** after which the motor will automatically stop. When the cycle ends and motor stops, the digital output to which the function with code 30 is additionally activated.

Please note: Time remaining to the end of the cycle can be checked through parameter **d0.20**.

Code	Description	Settings	Unit	Def.	Block
F7.45	Reaching the preset current time of operation	0.0 … 6500.0	min.	0	N

When the current time of operation (the drive is switched on) exceeds the value set in parameter **F7.45** then the digital output to which the function with code 40 is assigned will be activated.

Code	Description	Settings	Unit	Def.	Block
F7.50	Input **AI1** – Minimum voltage control	0.00 – **F7.51**	V	3.1	N
F7.51	Input AI1 – Maximum voltage control	**F7.50** – 10.00	V	6.8	N
If the voltage on the analog input **AI1** exceeds the level set in parameters **F7.50** – **F7.51** then the digital output to which the function with code 31 is assigned will be activated.					

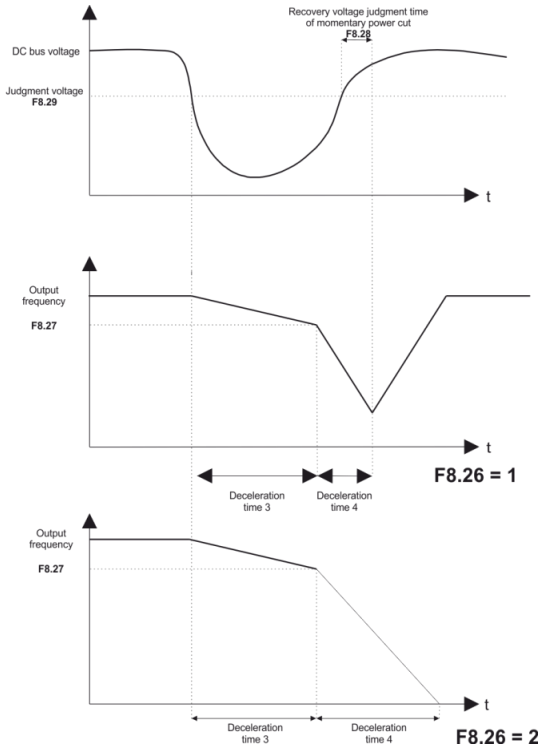
Security measures

Code	Description	Settings		Unit	Def.	Block
F8.00	Acceleration and braking current - multiplier	0 … 100		-	20	N
F8.01	Acceleration and braking current – threshold level	100 … 200		%	150	N
If the current during acceleration or braking exceeds the value set in the parameter **F8.01** then the acceleration (braking) process will be restricted until the current value drops below **F8.01**. Reaction speed (limiting the time of acceleration/braking) depends on the setting of parameter **F8.00**. The higher the value of parameter **F8.00**, the faster and stronger the response of the system. For drives with low inertia it is recommended to set smaller values of parameter F8.00 (for example at the default level). For drives with high inertia the value of parameter **F8.00** should be set to a higher value. When F8.00 = 0 then the function of limiting the acceleration/braking is inactive.						
F8.02	Over-torque control	Off	0	-	1	N
		On	1			
F8.03	Over-torque control – multiplier	0.20 … 10.00		-	1	N
Over-torque control system protects the motor from overheating caused by the operation at too high load. If torque control function is enabled (**F8.02**), the level of protection triggering will depend on the value of an overload and its duration. The greater the overload, the shorter the time to report error. For example: if the current is greater than the value of 220% * **F8.03** * Rated motor current then a shutdown occurs after 1 second. But if the current is at the level of 150% * **F8.03** * Rated motor current then a shutdown will occur after 60 seconds. **Please note:** The value of parameter **F8.03** must be set according to the actual motor overload rate. Too high value can lead to the situation that the protection will not work and the motor will be damaged.						
F8.04	Over-torque control – initial alarm	50 … 100		%	80	N
When the cumulative level of over-torque (resulting from current and time curve set with the parameter **F8.03**) exceeds the level set in parameter **F8.04**, the digital output DO to which the function with code 6 is assigned will be activated.						
F8.05	Over-voltage control - multiplier	0 … 100				
F8.06	Over-voltage control – threshold level	120 … 150		%	130	N
Over-voltage control protects the inverter against excessive voltage on the DC track resulting from the return of energy from the motor during hard braking. If the voltage on the DC track during braking exceeds the value set in parameter **F8.06** (measured against the rated DC voltage corresponding to the power from 3x400V electric network), the intensity of the braking speed will be reduced until the DC voltage returns to a safe value. The intensity of braking reducing depends on the setting of parameter **F8.05**. The higher the value of parameter **F8.05**, the bigger the reduction of braking speed (recommended for drives with high inertia).						

Code	Description	Settings		Unit	Def.	Block
F8.07	Input voltage – phase loss control	Off	0	-	1	N
		On	1			
Please note: applies only to the FA-3X220 inverter. Presence check for all phases of the power supply of the inverter. In the absence of phase the inverter is locked (drive cannot be started and remaining phases cannot be excessively loaded).						
F8.08	Output voltage – phase loss control	Off	0	-	1	N
		On	1			
Presence check for all phases of output voltage. It is absolutely recommended to leave this option turned on. No power at the output of the inverter may indicate a short circuit or damaged inverter.						
F8.09	Ground fault control	Off	0	-	1	N
		On	1			
If the ground fault control is enabled, then, after switching on the inverter power supply, test voltage appears for a moment on the output terminals to check whether there has been a ground fault on the inverter output. It is recommended to leave this option turned on.						
F8.10	Number of automatic restarts after error	0 … 20		-	0	N
Setting parameter **F8.10** to a value higher than zero allows the inverter to automatically restart if the error occurs. If the restart number exceeds the value set in parameter **F8.10**, the inverter will be permanently locked.						
F8.11	Alarm output state during the automatic restarts	Inactive	0	-	0	N
		Active	1			
If parameter **F8.11 = 0**, the output configured to indicate error will be activated only when the number of restarts exceeds the value of parameter **F8.10** and the inverter will be permanently locked. If the parameter **F8.11** = 1, the output will be activated after every error.						
F8.12	Time to automatic restart	0.1 … 100.0		s	1	N
Time from the moment the error occurred to the automatic sending of Reset signal by the inverter.						
F8.17	Reaction to error - 1	First digit of the parameter – xxxx**X** Overload (Error 11)		-	0	N
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Second digit – xxx**X**x No output phase (Error 12)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Third digit – xx**X**xx No output phase (error 13)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Fourth digit – x**X**xxx External error (Error 15)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			

Code	Description	Settings		Unit	Def.	Block
		Fifth digit – **X**xxxx Communication error (Error 16)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
F8.18	Reaction to error - 2	First digit of the parameter – xxxx**X** Damage to the encoder (Error 20)		-	0	N
		Motor coast to stop	0			
		Switching to U/f control and braking	1			
		Switching to U/f control and continuation of the operation	2			
		Second digit – xxx**X**x EEPROM memory error (Error 21)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		Third digit – xx**X**xx Reserve				
		Fourth digit – x**X**xxx Motor overheating (Error 45)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Fifth digit – **X**xxxx Reaching the preset operation time (Error 26)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
F8.19	Reaction to error - 3	First digit of the parameter – xxxx**X** External error 1 (Error 27)		-	0	N
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Second digit – xxx**X**x External error 2 (Error 18)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Third digit – xx**X**xx Reaching the preset time of inverter operation (Error 29)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Fourth digit – x**X**xxx Load drop (Error 30)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		Frequency reduction to 7% of rated frequency and continuation of the operation	2			
		Fifth digit – **X**xxxx				

Code	Description	Settings		Unit	Def.	Block
		PID – No feedback (Error 31)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Second digit – xxx**X**x Too high output speed (Error 43)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Third digit – xx**X**xx No output phase (Error 13)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Fourth digit – x**X**xxx External errors (Error 15)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
		Fifth digit – **X**xxxx Communication error (Error 16)				
		Motor coast to stop	0			
		Motor brake to stop	1			
		No reaction	2			
F8.24	Continuation of operation after error	Actual frequency	0			
		Preset frequency	1			
		Maximum frequency	2			
		Minimum frequency	3			
		Limited speed	4			
F8.25	Speed limit level	60.0 … 100.0		%	100	N
If an error occurs when the error handling procedure (parameters **F8.17** – **F8.19**) is to continue the operation, parameter **F8.24** determines the speed at which the motor will rotate after error. When parameter **F8.24** = 4, speed limit level is set with parameter **F8.25**. **F8.25** is scaled as a percentage of the maximum speed.						
F8.26	Reaction to temporary power failure	No reaction	0	-	0	N
		Braking	1			
		Braking to a stop	2			
F8.27	Frequency of braking time switching at power failure	80.0 … 100.0		%	90	N
F8.28	Delayed restart after power failure	0.00 … 100.00		s	0.5	N
F8.29	Threshold voltage at power failure	60.0 … 100.0		%	80	N
Parameters **F8.26** – **F8.29** determine the reaction of the inverter to a temporary power failure.						

Code	Description	Settings		Unit	Def.	Block
If parameter **F8.26 = 1**, when a power failure occurs and the DC voltage drops to level **F8.29** of rated value, motor will start to brake according to a braking time 3 (**F7.11**) until the frequency reach the value **F8.27**. Then the braking time will switch to value **F7.13** and the inverter will decelerate by that time until the return of the power supply (or until the motor comes to a complete stop if the power outage will be too long). When the supply voltage returns and the voltage on the DC track will be higher for a time **F8.28** than the threshold value **F8.29**, the inverter will restore the original motor frequency. If parameter **F8.26 = 2** the procedure is the same as in the previous case, but whether the power supply returns or not, the motor will be stopped. Characteristics for both cases are shown in the following figures.  						
F8.30	Load drop detection	On	0	-	0	N
		Off	1			
F8.31	Load drop – detection level	0.0 … 100.0		%	10	N
F8.32	Load drop – delay time	0.0 … 60.0		s	1	N
Load drop detection function allows protecting the motor from operating with too low load (for example in case of dry running). If the load current drops below the value **F8.31** (counted relative to the rated motor current) and stays below this value for a time **F8.32** error 30 will be reported and action defined in parameter **F8.19** will be performer.						

Communications parameters

Code	Description	Settings		Unit	Def.	Block
F9.00	Baud rate	First digit – xxxx**X** Modbus		-	6005	N
		300 bps	0			
		600 bps	1			
		1200 bps	2			
		2400 bps	3			
		4800 bps	4			
		9600 bps	5			
		19200 bps	6			
		38400 bps	7			
		57600 bps	8			
		115200 bps	9			
		Second digit – xx**X**x Reserve – for future using				
		Third digit – x**X**xx Reserve – for future using				
		Fourth digit –**X**xxx Reserve – for future using				
F9.01	Data format	(8 –N – 2) 8-bits, no parity, 2-stop bits	0	-	0	N
		(8 –E – 1) 8-bits, even parity, 1-stop bit	1			
		(8 –O – 1) 8-bits, odd parity, 1-stop bit	2			
		(8 –N – 1) 8-bits, no parity, 1-stop bit	3			
F9.02	This unit address	Modbus slave address	1 – 250	-	1	N
F9.03	Response delay	Time from receive request to send answer	0 – 20	ms	2	N
F9.4	Communication timeout time		0.0 – 60.0	s	0.0	N
F9.05	Data transfer format	First digit – xxxx**X**		-	30	N
		Non-standard Modbus protocol	0			
		Standard Modbus protocol	1			
		Second digit – xx**X**x Reserve – for future using				
F9.06	Read current resolution	0.01 A	0	-	0	N
		0.1	1			
F9.07	Reserve					

Torque control

FA parameters group is responsible for the configuration of the inverter to operate in motor torque control mode.

Code	Description	Settings		Unit	Def.	Block
FA.00	Speed/torque control	Speed control	0	-	0	Y
		Torque control	1			
Speed or torque control mode can be selected with parameter **FA.00** as well as with digital inputs to which the function with code 46 (switch between speed and torque control) is assigned. If these inputs are not used, parameter FA.00 determines the mode of control. If the inputs are set, then: If the input of the control mode switch (code 46) is inactive, the parameter **FA.00** defines the mode of operation. If it is active, the mode of operation is opposed to **FA.00** setting. If the input of torque control lock (code 29) is active, only the speed control mode will be carried out, regardless of the setting of parameter **FA.01**.						
FA.01	Sources of torque setting	Parameter **FA.02**	0	-	0	Y
		Analog input **AI1**	1			
		Analog input **AI2**	2			
		Potentiometer on the operator panel	3			
		High-speed pulse input **DI5**	4			
		Remote control	5			
		Smaller one of values **AI1** and **AI2**	6			
		Bigger one of values **AI1** and **AI2**	7			
FA.02	Torque setpoint	-200.0 … 200.0		%	150	N
FA.03	Torque increasing time	0.00 … 650.00		s	0	N
FA.04	Torque reduction time	0.00 … 650.00		s	0	N
In the torque control mode the resultant of motor speed is determined by the difference between the preset torque value and the torque load. **PLEASE NOTE:** In case of large differences between the actual and preset torque, the motor speed may increase rapidly to high level. In torque control mode, particular attention should be paid to the protection of the machine and the service staff against sudden changes of speed and load. Rapid changes of speed in torque control mode may be limited by extending the duration of torque increase and reduction.						
FA.05	Run „forward” – maximum frequency	0.00 … F0.19 (Maximum frequency)		Hz	50	N
FA.06	Run „reverse” – maximum frequency	0.00 … F0.19 (Maximum frequency)		Hz	50	N
Parameters **FA.05** and **FA.06** in torque control mode allow to specify the maximum output frequency of the inverter regardless of operation in „Forward” and „Reverse” direction.						
FA.07	Setpoint filter	0.00 … 10.0		s	0	N
Setpoint filter for pulse control allows obtaining average setpoint from the range set with parameter **FA.07**. This allows eliminating random interference that could translate into rapid surges of motor speed.						

PLC mode

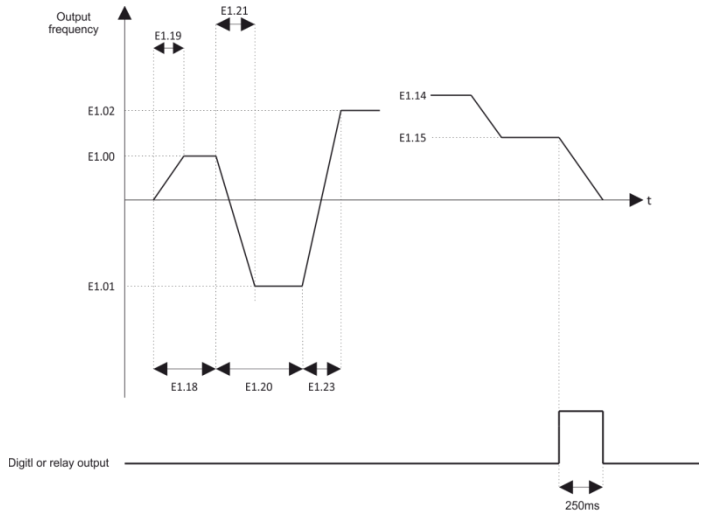
PLC mode allows programming a sequence of up to sixteen steps of actions performed automatically by the inverter. Speed, direction, motion time, acceleration time and braking time can be programmed for each step.

Code	Description	Settings	Unit	Def	Block
E1.00	Step 0 – Speed	-100.0 … 100.0	%	0	N
E1.01	Step 1 – Speed	-100.0 … 100.0	%	0	N
E1.02	Step 2 – Speed	-100.0 … 100.0	%	0	N
E1.03	Step 3 – Speed	-100.0 … 100.0	%	0	N
E1.04	Step 4 – Speed	-100.0 … 100.0	%	0	N
E1.05	Step 5 – Speed	-100.0 … 100.0	%	0	N
E1.06	Step 6 – Speed	-100.0 … 100.0	%	0	N
E1.07	Step 7 – Speed	-100.0 … 100.0	%	0	N
E1.08	Step 8 – Speed	-100.0 … 100.0	%	0	N
E1.09	Step 9 – Speed	-100.0 … 100.0	%	0	N
E1.10	Step 10 – Speed	-100.0 … 100.0	%	0	N
E1.11	Step 11 – Speed	-100.0 … 100.0	%	0	N
E1.12	Step 12 – Speed	-100.0 … 100.0	%	0	N
E1.13	Step 13 – Speed	-100.0 … 100.0	%	0	N
E1.14	Step 14 – Speed	-100.0 … 100.0	%	0	N
E1.15	Step 15 – Speed	-100.0 … 100.0	%	0	N

Outside of PLC mode parameters **E1.00** – **E1.15** can also be used as a common source of frequency setting and as a source for PID controller. In the first case the value of the parameter is scaled in relation to maximum frequency. In the second case the value of the parameter is scaled directly as the signal level for PID controller. Switching between the respective values is carried out via digital inputs that operates the multi-speed mode (functions with codes 12 – 15).

E1.16	PLC control mode	Motor stop after the end of the program	0	-	0	N
		Maintain last speed after the end of the program	1			
		Cyclical repetition of the program	2			

Parameter **E1.16** determines the manner in which the PLC program will be executed. Scheme of a single program execution is shown in the figure below:



There are three ways of program execution:

0 – Motor stop after the end of the program

Code	Description	Settings	Unit	Def	Block
		After the last step of the program the motor will be stopped. To run program again, cycle command Run must be repeated. **1- Maintain last speed after the end of the program** After the last step of the program, the frequency and direction from the last executed step of the program will be maintained at the output of the inverter. To run program again, cycle command Run must be repeated. **2 - Cyclical repetition of the program** Program will be executed cyclically as long as the Run signal will be active.			
E1.17	PLC – State memory	First digit – x**X** Preserving the state after power shut down Off – 0 On – 1 Second digit – **X**x Preserving the state after Stop command Off – 0 On – 1			
		Preserving the state after power shut down – if it's on, the inverter will remember the currently executed step of the PLC and when the power is back the execution of the program will be continued. If it is off, then after power restart the program will be executed from its first step. **Preserving the state after Stop command** – if it's on, then when the Run command is deactivated the inverter will remember the currently executed step of the PLC program. Activating the Run command again will execute the program from the point it was stopped. If it's off, then after break in the operation the state of the program will not be preserved and after motor restart the program will be executed from the beginning.			
E1.18	Step 0 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.19	Step 0 - Acceleration/braking time	0 … 3	-	0	N
E1.20	Step 1 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.21	Step 1 - Acceleration/braking time	0 … 3	-	0	N
E1.22	Step 2 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.23	Step 2 - Acceleration/braking time	0 … 3	-	0	N
E1.24	Step 3 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.25	Step 3 - Acceleration/braking time	0 … 3	-	0	N
E1.26	Step 4 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.27	Step 4 - Acceleration/braking time	0 … 3	-	0	N
E1.28	Step 5 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.29	Step 5 - Acceleration/braking time	0 … 3	-	0	N
E1.30	Step 6 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.31	Step 6 - Acceleration/braking time	0 … 3	-	0	N
E1.32	Step 7 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.33	Step 7 - Acceleration/braking time	0 … 3	-	0	N
E1.34	Step 8 – Operation time	0.0 … 6500.0	s (h)	0	N
E1.35	Step 8 - Acceleration/braking	0 … 3	-	0	N

Code	Description	Settings		Unit	Def	Block
	time					
E1.36	Step 9 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.37	Step 9 - Acceleration/braking time	0 … 3		-	0	N
E1.38	Step 10 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.39	Step 10 - Acceleration/braking time	0 … 3		-	0	N
E1.40	Step 11 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.41	Step 11 - Acceleration/braking time	0 … 3		-	0	N
E1.42	Step 12 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.43	Step 12 - Acceleration/braking time	0 … 3		-	0	N
E1.44	Step 13 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.45	Step 13 - Acceleration/braking time	0 … 3		-	0	N
E1.46	Step 14 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.47	Step 14 - Acceleration/braking time	0 … 3		-	0	N
E1.48	Step 15 – Operation time	0.0 … 6500.0		s (h)	0	N
E1.49	Step 15 - Acceleration/braking time	0 … 3		-	0	N
E1.50	Time scale	Seconds (s)	0	-	0	N
		Hours (h)	1			
E1.51	Source of frequency for Step 0	Parameter **E1.00**	0	-	0	N
		Analog input **AI1**	1			
		Analog input **AI2**	2			
		Potentiometer on the operator panel	3			
		High-speed pulse input **DI5**	4			
		Preset PID value	5			
		Frequency from parameter **F0.01** (modified with **Up/Down** buttons)	6			
Parameters **E1.18** – **E1.49** defines the time of specific program steps execution, as well as times of acceleration and braking within given step. Unit of time, for which the length of the step is calculated, is set with parameter **E1.50** – time can be set with steps of 1 second and 1 hour.						

PID controller

E2 parameters group allows configuring built-in PID controller.

To activate the controller the option of PID control must also be selected in main and auxiliary source of frequency setting (parameters **F0.03** and **F0.04**).

Code	Description	Settings		Unit	Def	Block
E2.00	PID – Source of setpoint	Parameter **E2.01**	0	-	0	N
		Analog input **AI1**	1			
		Analog input **AI2**	2			
		Potentiometer on the operator panel	3			
		High-speed pulse input	4			
		Remote control	5			

Code	Description	Settings		Unit	Def	Block
		Multi-step control	6			
E2.01	PID – setpoint	0.0 … 100.0		%	50	N
E2.00 determines the source of setpoint for PID controller. If **E2.00** = 0, the level of setpoint is set in parameter **E2.01**.  Setpoint and feedback are expressed in relative scale from 0 to 100 %.						
E2.02	PID – Feedback	Analog input **AI1**	0	-	0	N
		Analog input **AI2**	1			
		Potentiometer on the operator panel	2			
		AI2 – AI1	3			
		High-speed pulse input	4			
		AI1 + AI2	6			
		Bigger one of values **AI1** and **AI2**	7			
		Smaller one of values **AI1** and **AI2**	8			
E2.03	PID – Type of feedback	Positive	0	-	0	N
		Negative	1			
Positive – if the signal of feedback is smaller than the setpoint value, the output frequency will increase. **Negative** – if the signal of feedback is smaller than the setpoint value, the output frequency will decrease.						
E2.04	Scaling of display of the setpoint and feedback	0 … 65535		-	1000	N
E2.04 is a dimensionless multiplier used to scale the PID controller setpoint or feedback value to the form displayed in the parameters **d0.15** and **d0.16**. For example: if setpoint is equal to 100% and **E2.04** = 2000, parameter **d0.15** will display setpoint in the form of number 2000.						
E2.05	Frequency for opposite direction	0.00 … **F0.19** (Maximum frequency)		Hz	2	N
If the PID controller action changes the rotation direction to the opposite of the preset direction, parameter **E2.05** allows specifying the maximum output frequency for rotation opposite to the preset direction.						
E2.06	Minimum error	0.0 … 100.0		%	0	N
If the difference between the setpoint and the feedback is lower than the value of parameter **E2.06**, the controller output signal will not change (will remain at the previous level).						
E2.07		0.00 … 100.00		%	0.1	N
E2.08	Setpoint filter	0.00 … 650.00		s	0	N
E2.09	Feedback filter	0.00 … 60.00		s	0	N
E2.10	Output value filter	0.00 … 60.00		s	0	N
Parameters E2.08 – E2.10 allow filtering setpoint, feedback and controller output in order to reduce the controller sensitivity to rapid fluctuations of values, caused for example by interference.						
E2.11	Loss of feedback	0 – No control		%	0	N
		0.1 … 100.0				
E2.12	Loss of feedback detection time	0.0 … 20.0		s	0	N
If **E2.11** > 0, in the case where the value of feedback is less than the value of parameter **E2.11** for longer than the value of **E2.12**, error with code 31 will be reported.						
E2.13	Amplification factor **KP1**	0.0 … 100.0		-	20	N
E2.14	Integration time **TI1**	0.01 … 10.00		s	2	N

Code	Description	Settings		Unit	Def	Block
E2.15	Derivative time **TD1**	0.01 … 10.00		s	0	N
E2.16	Amplification factor **KP2**	0.0 … 100.0		-	20	N
E2.17	Integration time **TI2**	0.01 … 10.00		s	2	N
E2.18	Derivative time **TD2**	0.01 … 10.00		s	0	N
E2.19	Controller parameters switching	Off	0	-	0	N
		Using digital output **DI**	1			
		Automatic for preset error	2			
E2.20	PID parameters switching– initial error	0.0 … **E2.21**		%	20	N
E2.21	PID parameters switching– final error	E2.20 … 100.0		%	80	N

Basic parameters characterizing the operation of PID controller include:

Amplification factor KP – parameter characterizing the proportional part of the PID controller. The signal on the controller output will change in proportion to the error value and amplification factor **KP**. The higher the **KP** value, the stronger the controller reaction. If amplification factor **KP** = 100.0 and control error is equal to a 100%, the output of proportional controller will set the maximum output frequency.
Integration time TI – parameter characterizing an integrating part of the PID controller. If control error is constant, the integral controller reaction will increase in linear fashion with speed dependent on the integration time. The shorter the value of **TI**, the faster the controller reaction. If control error is equal to a 100%, the integration controller output will linearly change the frequency from zero to maximum value in time **TI**.

Derivative time TD – parameter characterizing the derivative part of the PID controller. Signal on the output of derivative controller will depend on the changes in control error value and the set value of the **TD** parameter. The higher the value of **TD**, the stronger the reaction of the controller to the changes of error.

The FA-3X inverter allows defining to sets of PID controller parameters. These parameters can be switched with parameter **E2.19** setting. If the switching is based on the signal applied on the digital input **DI** (**E2.19** = 1), then to the switching input must be assigned function with code 43. If the switching is based on the control error (**E2.19** = 2), then:

1. If the control error is smaller than the value of parameter **E2.20**, the controller operates according first set of parameters (**KP1**, **TI1**, **TD1**).
2. If the control error is higher than the value of parameter **E2.21**, the controller operates according to the second set of parameters (**KP2**, **TI2**, **TD2**).
3. If the control error is in the range of **E2.20** to **E2.21**, the parameters of controller are calculated as a linear approximation of both sets of parameters.

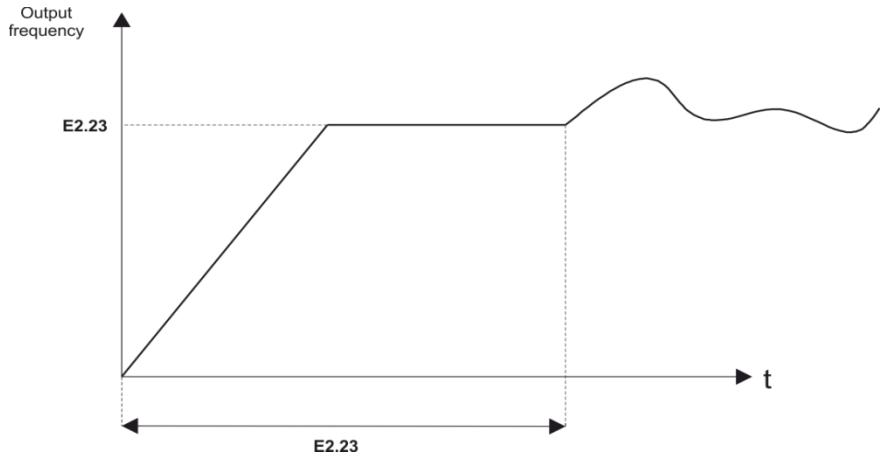
E2.22	Integration controller properties	First digit – x**X** Integration hold		-	0	N
		Off	0			
		On	1			
		Second digit – **X**x Integration stop after reaching maximum value				
		Off	0			
		On	1			

Integration hold

If the digital input DI is in use, to which the integration part hold function (function with code 38) is assigned, then when that input is active, the integrating controller operation is blocked (the value of the integration part remains at the same level).

Code	Description	Settings	Unit	Def	Block
Integration stop after reaching the maximum value If the reaction of the integration part reaches the value of 100% and this function is enabled, the signal from the integration part will not increase anymore.					
E2.23	Initial value	0.0 … 100	%	0	N
E2.24	Maintaining the initial speed	0.00 … 3600.00	s	0	N

When the drive starts, the initial setpoint E2.23 is forced on the output of the controller and maintained for the duration of E2.24. Only after set time the value on the controller output will depend on the value of the control error and controller settings. Scheme of function operation is shown in the figure below:



Motor parameters

Code	Description	Settings		Unit	Def.	Block
b0.00	Type of the motor	Asynchronous motor	0	-	0	Y
		Asynchronous motor dedicated to inverter drives	1			
		Synchronous motor with permanent magnet	2			
b0.01	Rated power	0.1 … 1000.0		kW	-	Y
b0.02	Rated voltage	1 … 2000		V	-	Y
b0.03	Rated current	0.01 … 655.35		A	-	Y
b0.04	Rated frequency	0.01 … **F0.19** (Maximum frequency)		Hz	-	Y
b0.05	Rated speed	1 … 36000		rpm	-	Y

Motor parameters **b0.00** – **b0.05** are to be set exactly as they are on the rated plate of the motor. It is especially important in case of using vector control and automatic motor tuning.

Please note:
To utilize the vector control features as best as possible it is recommended to adjust the inverter power to the motor power so that the motor rated current varied from 30 to 100% of rated inverter current.

b0.06	Asynchronous motor - stator resistance	0.001 … 65.535	Ω	-	Y
b0.07	Asynchronous motor - rotor resistance	0.001 … 65.535	Ω	-	Y
b0.08	Asynchronous motor - leakage inductance	0.01 … 655.35	mH	-	Y
b0.09	Asynchronous motor – mutual inductance	0.01 … 655.35	mH	-	Y
b0.08	Asynchronous motor – no-load current	0.01 … **b0.03**	A	-	Y

Parameters **b0.06** – **b0.10** are calculated in the process of automatic tuning of the motor and are necessary for proper operation of the drive in the vector control mode. If the tuning is done on the stopped motor, the inverter identifies only parameters **b0.06** – **b0.08**.

Please note:
If motor automatic tuning cannot be performed, correct and proper parameters need to be obtained from the motor manufacturer and saved in parameters **b0.06** – **b0.10**.

b0.11	Synchronous motor - stator resistance	0.001 … 65.535	Ω	-	Y
b0.12	Synchronous motor – D-axis inductance	0.01 … 655.35	mH	-	Y
b0.13	Synchronous motor - Q-axis inductance	0.01 … 655.35	mH	-	Y
b0.14	Synchronous motor - reverse EM force	0.1 … 6553.5	V	-	Y

Parameters b0.11 – b0.14 apply to the case when the synchronous motor with permanent magnets is connected to the inverter. Parameters values are determined in the process of automatic motor tuning.

Code	Description	Settings		Unit	Def.	Block
b0.27	Motor parameters automatic tuning	Inactive	0	-	0	Y
		Asynchronous motor – tuning with the motor stopped	1			
		Asynchronous motor – tuning with the motor running	2			
		Synchronous motor – tuning with the motor stopped	11			
		Synchronous motor – tuning with the motor running	12			

Please note:
Automatic tuning of motor parameters is an essential process if the motor has to operate in vector control mode. If the motor shaft load can be detached for the tuning, it is recommended to carry out the tuning with the motor running. If the is no way to start the motor without load, the tuning must be performed with the motor stopped.

Please note:
Before starting the motor tuning, enter the correct motor data to parameters **b0.00** – **b0.05**.

1 – Asynchronous motor – tuning with the motor stopped

Selecting the option of tuning with the motor stopped will measure the rotor and stator resistance as well as leakage inductance. The resulting values will be saved in parameters **b0.06** – **b0.08**.

2 – Asynchronous motor – tuning with the motor running

The tuning process with the motor running is carried out in two stages. First stage are the measurements with the motor stopped (measured are: stator and rotor resistance as well as leakage inductance). In the second stage the motor is started and accelerated to 80% of the rated speed according to the acceleration time **F0.13**, and then decelerated to zero based on the braking time **F0.14**. Other motor parameters are identified based on that.

11 – Synchronous motor – tuning with the motor stopped

12 – Synchronous motor – tuning with the motor running

Tuning for synchronous motor is carried out in the same way as for the asynchronous motor.

Security and default settings

Code	Description	Settings		Unit	Def	Block
y0.00	Parameter initialization	No action	0	-	0	Y
		Restore the default parameters (except for the motor configuration)	1			
		History clearing	2			
		Restore the default configuration of all parameters	3			
		Save backup of the current configuration	4			
		Restore inverter configuration from backup	501			

1 – Restore the default parameters (except for motor configuration)

Setting **y0.00** = 1 will reset most of the inverter settings to the default values. Changes will not affect:
- motor configuration (parameters **b0.00** – **b0.14**)
- frequency step (parameter **F0.02**)
- error history
- switch-on time, operation time, energy consumption

2 – History clearing

History clearing erases information about the history of errors, switch-on time and operation time of the inverter as well as about power consumption.

3 – Restore the default configuration of all parameters

Restoring the default values of all inverter parameters.

4 – Save backup of the current configuration

All configuration parameters are stored in additional backup.

501 – Restore inverter configuration from backup

Restoring the complete configuration of the inverter from the previously created backup.

y0.01	Password	0 … 65535	-	0	N

If parameter **y0.01** is set to a value higher than zero, then each subsequent entry to the inverter configuration will require a valid password that is set here.

If you set a password, make sure that it has not been lost or forgotten, as this may lead to the inability to change the configuration of the inverter.

Setting of parameter y0.01 = 0 removes the security settings of the inverter.

Errors

Code	Description	Settings	Unit	Def.	Block
y1.00	Code of the first error (the youngest)	0 … 51	-	-	Y
y1.01	Code of the second error	0 … 51	-	-	Y
y1.02	Code of the third error (the oldest)	0 … 51	-	-	Y

Parameters y1.00 – y1.02 store information about the codes of three recently registered errors. List of errors is presented in the table below. More information about the particular errors and the reasons of their occurrence can be found in the appendix devoted to errors.

Code of error	Description
0	No errors
1	General security error
2	Exceeding the current during acceleration
3	Exceeding the current during braking
4	Exceeding the current during constant speed operation
5	Exceeding the voltage on the DC track during acceleration
6	Exceeding the voltage on the DC track during braking
7	Exceeding the voltage on the DC track during constant speed operation
9	Too low supply voltage
10	Inverter overload
11	Motor overload
12	Supply phase failure
13	Output phase failure
14	Exceeding the threshold temperature of inverter power module
15	External error
16	Communication error
17	Contactor damage
18	Improper operation of the current control system
19	Motor parameters identification error
21	EEPROM memory error
22	Improper operation of the inverter circuits
23	Ground fault on the motor side
26	Reaching the preset operation time
27	External error 1
28	External error 2
29	Reaching the preset switch-on time of the inverter
30	Load loss
31	No feedback signal in PID controller mode
45	Exceeding the temperature of the motor

y1.03	Error 3	Frequency	Output frequency when the error occurred	Y
y1.04		Current	Output current when the error occurred	Y
y1.05		Voltage on the DC track	Voltage on the DC track when the error occurred	Y
y1.06		Digital inputs state	State of the digital inputs when the error occurred. If the input was active, the corresponding bit is set to 1. If the input is	Y

<table>
<tr><th>Code</th><th colspan="2">Description</th><th>Settings</th><th>Unit</th><th>Def.</th><th>Block</th></tr>
<tr><td></td><td rowspan="4"></td><td></td><td>inactive, the corresponding bit is set to 0.

<table><tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>DI</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td>y1.07</td><td>Digital outputs state</td><td>State of the digital outputs when the error occurred. If the input was active, the corresponding bit is set to 1. If the input is inactive, the corresponding bit is set to 0.
<table><tr><td>Bit</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>DO</td><td>REL2</td><td>SPA</td><td>-</td><td>REL1</td><td>SPB</td></tr></table></td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.09</td><td>Switch-on time</td><td>Time from the start of the inverter to the error</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.10</td><td>Operation time</td><td>Time from the start of the motor to the error</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.13</td><td rowspan="5">Error 2</td><td>Frequency</td><td>Output frequency when the error occurred</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.14</td><td>Current</td><td>Output current when the error occurred</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.15</td><td>Voltage on the DC track</td><td>Voltage on the DC track when the error occurred</td><td></td><td></td><td>T</td></tr>
<tr><td>y1.16</td><td>Digital inputs state</td><td>State of the digital inputs when the error occurred. If the input was active, the corresponding bit is set to 1. If the input is inactive, the corresponding bit is set to 0.
<table><tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>DI</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr></table></td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.17</td><td>Digital outputs state</td><td>State of the digital outputs when the error occurred. If the input was active, the corresponding bit is set to 1. If the input is inactive, the corresponding bit is set to 0.
<table><tr><td>Bit</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>DO</td><td>REL2</td><td>SPA</td><td>-</td><td>REL1</td><td>SPB</td></tr></table></td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.19</td><td>Switch-on time</td><td>Time from the start of the inverter to the error</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.20</td><td>Operation time</td><td>Time from the start of the motor to the error</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.23</td><td rowspan="4">Error 1</td><td>Frequency</td><td>Output frequency when the error occurred</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.24</td><td>Current</td><td>Output current when the error occurred</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.25</td><td>Voltage on the DC track</td><td>Voltage on the DC track when the error occurred</td><td></td><td></td><td>Y</td></tr>
<tr><td>y1.26</td><td>Digital inputs state</td><td>State of the digital inputs when the error occurred. If the input was active, the corresponding bit is set to 1. If the input is inactive, the corresponding bit is set to 0.
<table><tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>DI</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr></table></td><td></td><td></td><td>Y</td></tr>
</table>

<table>
<tr><th>Code</th><th colspan="2">Description</th><th>Settings</th><th>Unit</th><th>Def.</th><th>Block</th></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td><td></td></tr>
<tr><td>y1.27</td><td colspan="2">Digital outputs state</td><td colspan="3">State of the digital outputs when the error occurred. If the input was active, the corresponding bit is set to 1. If the input is inactive, the corresponding bit is set to 0.

<table><tr><td>Bit</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>DO</td><td>REL2</td><td>SPA</td><td>-</td><td>REL1</td><td>SPB</td></tr></table></td><td>Y</td></tr>
<tr><td>y1.29</td><td colspan="2">Switch-on time</td><td colspan="3">Time from the start of the inverter to the error</td><td>Y</td></tr>
<tr><td>y1.30</td><td colspan="2">Operation time</td><td colspan="3">Time from the start of the motor to the error</td><td>Y</td></tr>
</table>

Part 6. Error identification

Code of the error	Problem	Possible cause	Solution
Err.01	General error	1. Short circuit on the inverter output. 2. Too long cables between the motor and the inverter. 3. Too high temperature of the power module. 4. Damaged connections inside the inverter. 5. Damaged control module of the inverter. 6. Damaged power module. 7. Improper operation of the control module. 8. Improper operation of the power module.	1. Check the connections outside of the inverter. 2. Install additional output filter and/or reduce the switching frequency. 3. Check the condition of the fan. If necessary, clean the fan and gaps between ribs of the heat sink. 4. Check the connections of operator panel and extensions modules. 5. In other cases, report the problem to the service department.
Err.02	Overload during acceleration	1. Acceleration time is too short. 2. Too strong torque boost or incorrectly selected U/f characteristic. 3. Too low supply voltage. 4. Short circuit on the output of the inverter. 5. Vector control mode was set without correct parameters identification. 6. Attempt to start the rotating motor. 7. Rapid load increase on the inverter output. 8. Incorrectly selected size of the inverter.	1. Increase the acceleration time. 2. Change the settings of U/f characteristic and torque boost. 3. Ensure the power supply with appropriate voltage level. 4. Check the connections outside of the inverter. 5. Enter correct motor parameters and tune the parameters. 6. Set the option of speed tracking. 7. Check the load for sudden changes in load (for example caused by the locked motor). 8. Use a higher capacity inverter.

Err.03	Overload during braking	1. Short circuit on the inverter output. 2. Vector control mode was set without correct parameters identification. 3. Braking time is too short. 4. Too low supply voltage. 5. Rapid load increase on the inverter output. 6. No braking resistor.	1. Check the connections outside of the inverter. 2. Enter correct motor parameters and perform automatic tuning. 3. Extend braking time. 4. Ensure the power supply with appropriate voltage level. 5. Check the load for sudden changes in load (for example caused by the locked motor). 6. Install the resistor or braking module.
Err.04	Overload during constant speed	1. Short circuit on the output of the inverter. 2. Vector control mode was set without correct parameters identification. 3. Too low supply voltage. 4. Rapid load increase on the inverter output. 5. Incorrectly selected size of the inverter.	1. Check the connections outside of the inverter. 2. Enter correct motor parameters and perform automatic tuning. 3. Ensure the power supply with appropriate voltage level. 4. Check the load for sudden changes in load (for example caused by the locked motor). 5. Use a higher capacity inverter.
Err.05	Too high DC voltage during acceleration	1. Too high supply voltage. 2. There is an additional force driving the motor (for example air pressing on the fan blades). 3. Acceleration time is too short.	1. Ensure the power supply with appropriate voltage level. 2. Eliminate the possibility of an additional driving force influence or set the start-up with tracking speed option. 3. Extend the acceleration time.
Err.06	Too high DC voltage during deceleration	1. Too high supply voltage. 2. There is an additional force restraining deceleration (for example high moment of inertia). 3. Braking time is too short. 4. No braking resistor.	1. Ensure the power supply with appropriate voltage level. 2. Adjust the deceleration time to the moment of inertia or use coast to stop. 3. Extend the braking time. 4. Install braking resistor or braking module.
Err.07	Too high DC voltage at a constant speed	1. There is an additional force driving the motor (for example air pressing on the fan blades). 2. Too high supply voltage.	1. Eliminate the possibility of an additional driving force influence or install a braking resistor. 2. Ensure the power supply with appropriate voltage level.
Err.09	Voltage loss	1. Temporary loss of power. 2. Input voltage is lower than required. 3. Voltage on the DC track is not correct. 4. Damaged inverter input track. 5. Damaged power module. 6. Damaged control module.	1. Clear the error. 2. Ensure the power supply with appropriate voltage level. 3. In other cases, report the problem to the service department.
Err.10	Inverter overload	1. Incorrectly selected size of the inverter. 2. Too high motor load or motor lock.	1. Use a higher capacity inverter. 2. Reduce the load of the motor. Perform servicing and maintenance of the motor.

Err.11	Motor overload	1. Incorrectly selected size of the inverter. 2. Incorrectly set thermal protection (parameter **F8.03**) 3. Too high motor load or motor lock.	1. Use a higher capacity inverter. 2. Set parameter **F8.03** to a value adapter to the connected motor. 3. Reduce the load of the motor. Perform servicing and maintenance of the motor.
Err.12	Input voltage phase failure	1. One of the supply voltage phases is not connected. 2. Damaged contactor that limits the initial current. 3. Incorrect inverter operation. 4. Damaged input module. 5. Damaged control board.	1. Verify the power supply connection to the inverter. 2. In other cases, report the problem to the service department.
Err.13	Output phase failure	1. Damaged wires between the motor and the inverter. 2. Imbalanced output voltage during motor operation. 3. Damaged power module. 4. Damaged control board.	1. Verify the connections between the motor and the inverter. 2. Check the impedance of motor windings and the resistance of motor insulation. 3. In other cases, report the problem to the service department.
Err.14	Exceeding the module temperature	1. Disturbed airflow around the inverter. 2. Too high ambient temperature. 3. Damaged fan. 4. Damaged temperature sensor. 5. Damaged power module.	1. Clean the inverter heat sink, clean the fan. 2. Replace the fan. 3. Reduce ambient temperature (bigger control cabinet, improved ventilation in the cabinet in which the inverter is installed). 4. In other cases, report the problem to the service department.
Err.15	External error	External error reported via the digital input to which the function with code 11 or 33 is assigned.	Confirm and clear the error message.
Err.17	Input contactor damage	1. One of the supply voltage phases is not connected. 2. Damaged internal input contactor. 3. Damaged input track of the inverter.	1. Verify the connection and power supply of the inverter. 2. In other cases, report the problem to the service department.
Err.18	Current measurement error	Damaged current measurement system or inverter control board.	Report the problem to the service department.
Err.19	Motor parameters identification error	1. Incorrect setting of motor parameters (parameters **b0.00** – **b0.05**) 2. Exceeding the motor parameters identification time.	1. Enter the correct parameters from the rating plate. 2. Verify the motor connection, windings impedance and insulation resistance.
Err.21	EEPROM memory error	Damaged inverter internal memory that stores device configuration.	Report the problem to the service department.
Err.22	Improper operation of the inverter circuits	The cause may be, for example, inverter operation disruption caused by rapid fluctuations of supply voltage.	If the error persists, report it to the service department.

Err.23	Ground fault on the motor side	1. Damaged wires between the motor and the inverter. 2. Improperly connected motor. 3. Damaged motor windings. 4. Damaged power module.	Check the condition and the accuracy of the motor connection as well as the quality of the cable between the motor and the inverter. In other cases, report the problem to the service department.
 Do not turn on the inverter again until the cause of failure is identified and removed. 			
Err.26	Reaching the preset operation time	Reaching the preset operation time (set in parameter **F7.21**)	Clear the inverter history using the function to restore the default configuration of the inverter.
Err.27	External error 1	External error occurrence reported on the digital input DI to which the function with code 44 is assigned.	Confirm and clear the error message.
Err.28	External error 2	External error occurrence reported on the digital input DI to which the function with code 45 is assigned.	Confirm and clear the error message.
Err.29	Reaching the preset switch-on time of the inverter	Reaching the preset switch-on time (set in parameter **F7.20**)	Clear the inverter history using the function to restore the default configuration of the inverter.
Err.30	Load loss	Load current of the inverter is lower than value set in parameter **F8.31**	Check whether the cause of the error is actual and dangerous loss of power (for example dry running) or incorrect setting of parameters **F8.31** and **F8.32**
Err.31	No feedback signal in PID controller mode	The value of feedback signal is lower than the minimum value set in parameter E2.11	Check the source of the feedback for proper operation and the accuracy of parameter **E2.11** setting.

Part 7. Inverter specification

Power supply	Voltage and frequency	3 x 400 V (±10%), 50/60 Hz (±5%)
	Output voltage	3x400 V (for 400 V power supply)
	Output frequency	0.00 – 3200 Hz (U/f control) 0.00 – 300.00 Hz (vector control)
	V/F control characteristic	1) Constant torque characteristic 2) Reduced torque characteristic 3) Torque characteristic set by the user 4) Vector control (sensor and sensorless)
	Initial torque	180% for 0.50 Hz
	Dynamics of speed control	1: 100
	Stability of output speed	±0.5%
	Torque boost	In V/F control mode – automatic or user defined.
	Acceleration/deceleration	Linear or programmable S curve characteristic. Maximum acceleration and deceleration time – 6500 s.
	Frequency setting accuracy	Digital frequency setting: 0.01 Hz(f <= 100 Hz), 0.1 Hz (> 100 Hz). Analog frequency setting: 1% of maximum frequency.
	Overload	1) 150% of rated current for 1 minute. 2) 200% of rated current for 0.1 s.
	Motor slip compensation	In V/F control mode the motor slip compensation can be automatic.
Security	Inverter protection	1) Against too high and too low supply voltage. 2) Against exceeding the maximum current. 3) Against too high load. 4) Against the loss of speed and motor stall. 5) Against the current leak to the ground. 6) Against inverter overheating. 7) Additionally, the inverter is protected against communication errors or incorrect feedback signal.
	Safety switch	Input or button can be programmed to act as a safety switch that immediately cuts off the voltage from the inverter outputs.
	Settings protection	Inverter settings can be protected with PIN.
	Error clearing	Both automatic and manual error clearing can be set.
Braking	DC braking or using the external braking resistor.	
IO	6 digital inputs	1) Input triggering with both the low (COM) and high (+24 V) level. 2) A large function programming freedom – among other things: forward and reverse run, test forward and reverse run, safety switch, reset, multi-step speed control, motorized potentiometer, changing the acceleration and deceleration time, pulse input and others.
	3 analog inputs	1) They can operate both as voltage inputs (0 ~ 10 V) and current inputs 0 ~ 20 mA (range 4 ~ 20 mA can also be programmed). 2) Analog inputs can be used for, among other things, setting frequency and torque as well as cooperating with PID controller.
	2 analog outputs	1) They can operate both as voltage inputs (0 ~ 10 V) and current inputs 0 ~ 20 mA.

		2) Analog outputs can be programmed to indicate: a. preset and actual frequency; b. voltage and output current; c. voltage on the DC bus; d. IGBT power amplifier temperature; e. output power; f. rotational speed of the motor; g. driving torque.
	2 transistor outputs.	1) High-speed pulse output (maximum frequency of 100 kH). Possible indications: a. preset frequency; b. actual frequency; c. current value; d. output voltage; e. voltage on the DC bus; f. power amplifier temperature; g. output power; h. rotational speed of the motor; i. output torque. 2) Transistor load – maximum 20 mA/27 V
	1 relay output	1) Contact load 5 A/250 V AC or 5 A/30 V DC 2) Many possibilities in output functions programming (indications of 34 different states of the inverter).
Speed control	1) Wide range of speed settings, including different combinations of digital inputs, analog inputs, potentiometer and buttons on the operator panel, pulse inputs and motorized potentiometer. 2) Multi-step speed – 16 different speed and eight times of acceleration/deceleration can be set. 3) PLC mode – sequence of up to eight steps for the inverter to automatically perform can be set. For each of the steps user can determine motor speed, acceleration/deceleration time and the duration of the step. It can be also set whether the sequence will be executed only once, or will it be repeated in a loop.	
PID	Built-in PID controller helps in adjusting the drive operation to the requirements of the technological process. Both the setpoint and the feedback signal can be introduced from one of the following sources: 1) Control panel (buttons or potentiometer); 2) Analog inputs; 3) Digital inputs; 4) Pulse input.	
Environmental conditions	Operating temperature	-10℃ ~ 40℃. If the temperature exceeds 40°C, maximum output current is reduced by 1% with each additional °C
	Storage	-20℃~+65℃
	Humidity	Below 90 %, without moisture condensation
	Height	0 ~ 1000 m
	Installation	Installation in a vertical position inside the control cabinet with good ventilation and on the mounting plate made of non-combustible material. Method of installation must also protect the inverter from direct sunlight, dust, moisture, corrosive or explosive gases.

	Installation	Cooling by natural and forced airflow.

Table of types

Inverter type	Input voltage	Input current	Output voltage	Output current	Maximum motor power	Length L	Width W	Height H
	V	A	V	A	**kW**	mm	mm	mm
FA-3X007	3x400	4.3	3x400	2.5	**0.75**	185	120	165
FA-3X015	3x400	5.0	3x400	3.8	**1.5**	185	120	165
FA-3X022	3x400	5.8	3x400	5.1	**2.2**	185	120	165
FA-3X040	3x400	10.5	3x400	9.0	**4.0**	220	150	182
FA-3X055	3x400	14.6	3x400	13	**5.5**	220	150	185
FA-3X075	3x400	20.5	3x400	17	**7.5**	285	180	200

Assembly drawings

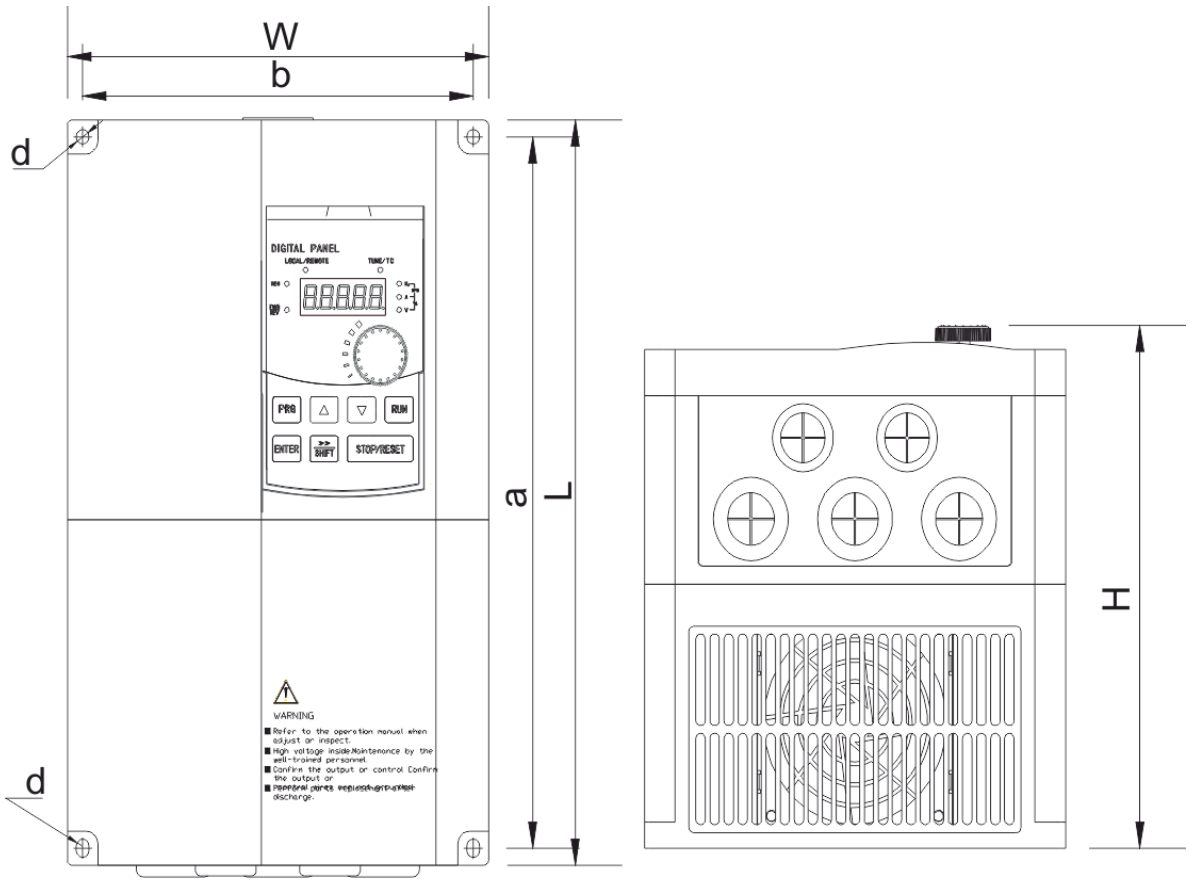


Figure 11) Dimensions of the inverter and placement of the mounting holes.

Mounting holes:

Inverter type	Length a	Width b	Diameter d
	mm	mm	mm
FA-3X007	174	108	5.3
FA-3X015	174	108	5.3
FA-3X022	174	108	5.3
FA-3X040	209	138	5.3
FA-3X055	209	138	5.3
FA-3X075	272	167	5.5

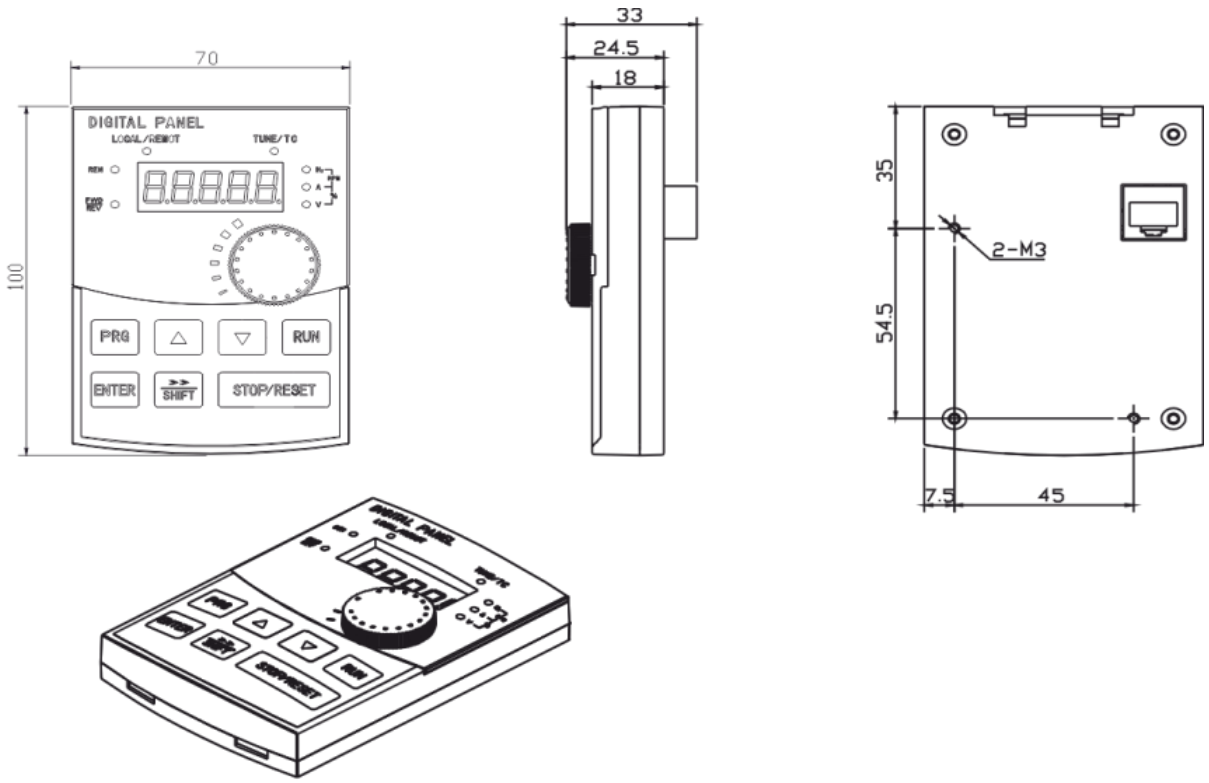


Figure 12) Operator panel – dimensions and mounting

Selection of braking resistors

If the high efficiency of braking is required, use additional braking resistors that dissipate the energy transmitted from braking drive to the inverter DC link circuit.

	Do not, under any circumstances, use resistors with lower resistance or lower power than shown in the table below. Failure to do so may result in damage to the inverter and there is a danger of fire.

Type	Inverter power	Braking resistor resistance	Resistor power
	kW	Ω	W
FA-3X007	0.75	750	120
FA-3X015	1.5	400	300
FA-3X022	2.2	250	300
FA-3X040	4.0	150	500
FA-3X055	5.5	100	500
FA-3X075	7.5	75	780

Warranty

1. The inverter comes with a 24 month warranty. The term of this warranty begins on the purchase date of the product.
2. The warranty is valid only with a proof of purchase.
3. The notification of the complaint must be made at the place of purchase or directly at the manufacturer:

F&F Filipowski sp. j.
ul. Konstantynowska 79/81
95-200 Pabianice
Phone: (42) 227-09 71
e-mail: dztech@fif.com.pl

4. Written information about the nature of the fault and the circumstances of its occurrence must be attached to the notification of the complaint.
5. F&F Filipowski sp. j. commits itself to review the complaints in accordance with Polish law.
6. The choice of the form of settling the customer complaint: replacement of the product for the product free from defects, repair or refund belongs to the manufacturer.
7. Warranty does not cover:
    a. Mechanical and chemical damages.
    b. Damages resulting from improper use or inconsistent with the user manual.
    c. Damages incurred after the sale as a result of accidents or other events for which nor the producer, nor the place of sale are responsible, for example damages in transit.
8. Warranty does not cover actions that user should perform in accordance with the user manual, for example installing multi-meter, building electrical installation, installing other required electrical protection.
9. Warranty does not limit the buyer's rights arising from the nonconformity of goods with the contract.