

• 15R0132B100 •

SINUS S

AC DRIVE 0.37 ... 37 kW / 0.5 ... 50 HP

QUICK CONFIGURATION GUIDE

Issued on 21/10/2022

R.01

Firmware version V06.02.36.12

English

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Steps to follow for configuration:

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**RESET OF PARAMETERS
TO FACTORY DEFAULTS**
chapter 2

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TO THE MOTOR**
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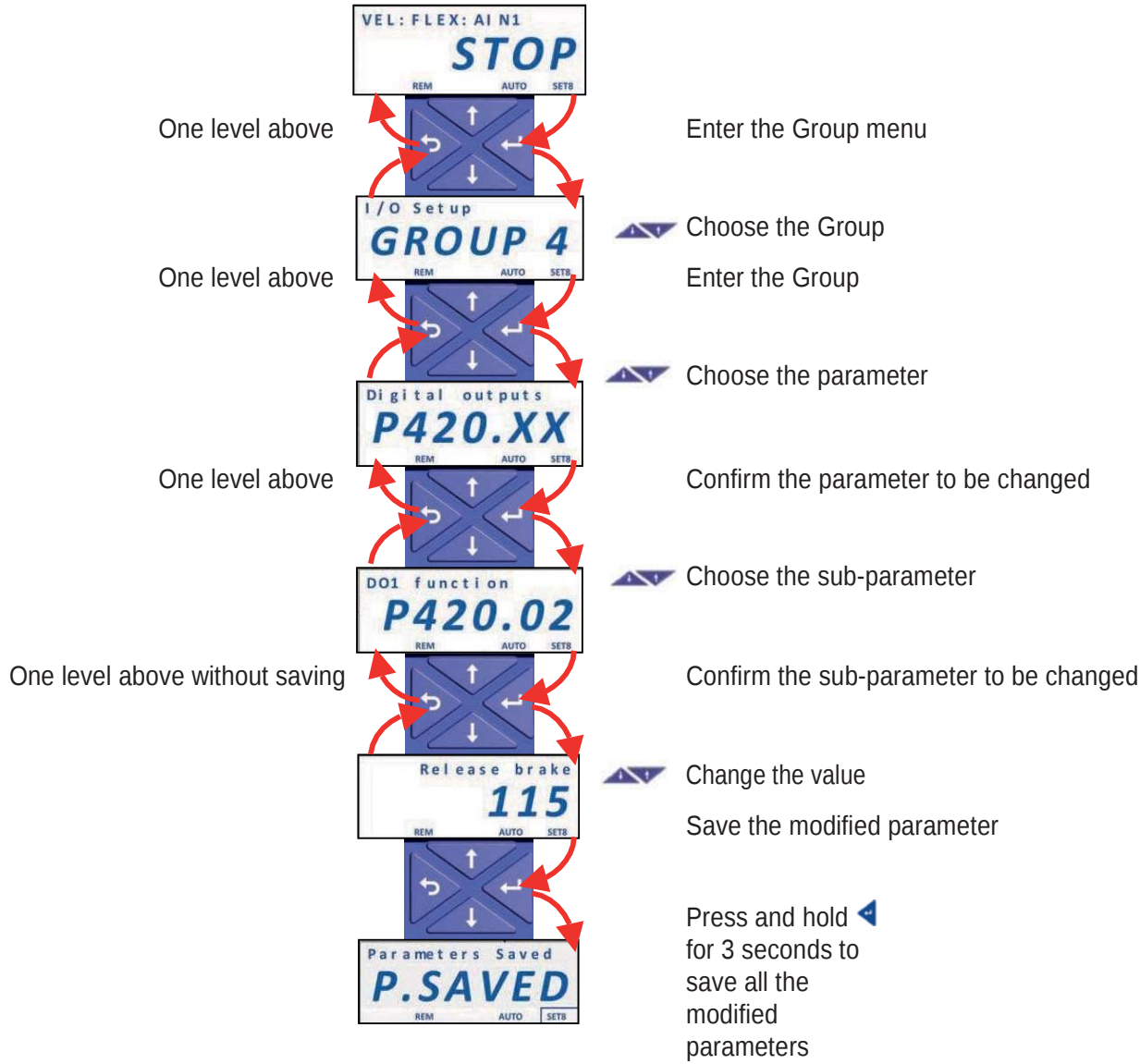
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1. NAVIGATION AMONG THE MENUS

Function of the keypad keys

Navigate: Select group/parameter. Change parameter setting.		
Navigate to one level below. Exit editing mode and accept new setting. More than 3 s: save parameter settings.		
Navigate to one level above. Exit editing mode without accepting new setting.		
Stop motor		
Run motor		
Activate full keypad control		
Reversal of rotation direction		

Example of navigation in the inverter menus.



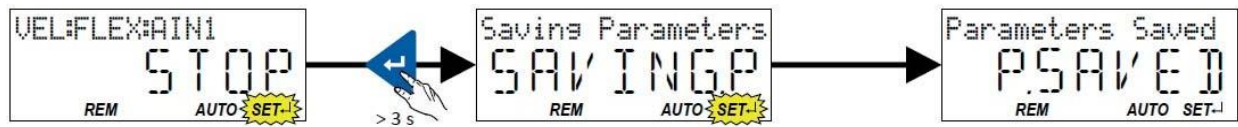
2. RESET OF PARAMETERS TO FACTORY DEFAULTS

To reset the inverter parameters to factory defaults, follow this procedure:

– Set parameter P700.01 = 1 (Resetting parameters to default)

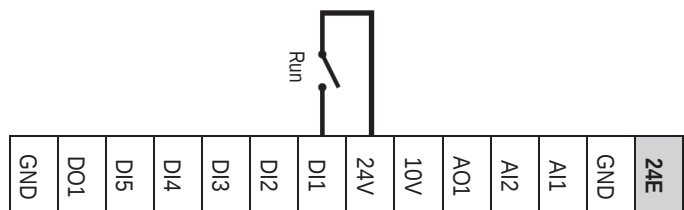
– Press the key  several times to exit the programming menu until STOP is displayed.

– Press and hold the key  for 3 seconds until the "P.SAVED" indication appears, indicating that the settings have been saved.



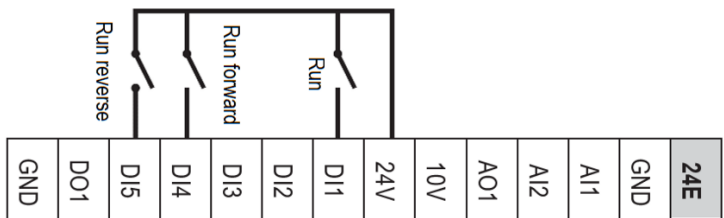
3. START/STOP COMMANDS TO THE MOTOR

3.1 From contact on the terminal board – Two-wire command



Parameter	Function	Value	Description
P400.01	Enable inverter	1	Inverter always enabled (default)
P400.02	Run command	11	Assign the function to DI1 digital input (default)

3.2 Forward / reverse run with contacts on the terminal board



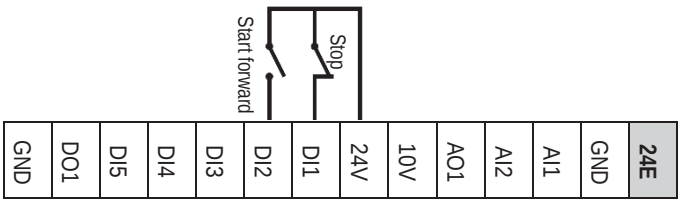
Parameter	Function	Value	Description
P400.01	Enable inverter	1	Inverter always enabled (default)
P400.02	Run command	11	Assign the function to DI1 digital input (default)
P400.18	Activate preset bit 0 (default: DI4)	0	Disable the function from DI4 digital input
P400.08	Run forward	14	Assign the function to DI4 digital input
P400.19	Activate preset bit 1 (default: DI5)	0	Disable the function from DI5 digital input
P400.09	Run reverse	15	Assign the function to DI5 digital input

3.3 From on-board Keypad



Parameter	Function	Value	Description
P400.01	Enable inverter	1	Inverter always enabled (default)
P400.12	Enable Keypad control	1	Control from Keypad enabled

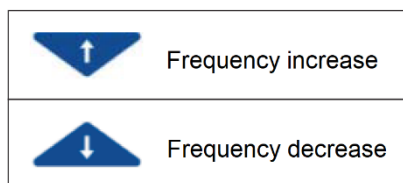
3.4 From contacts on the terminal board – Three-wire command



Parameter	Function	Value	Description
P400.01	Enable inverter	1	Inverter always enabled (default)
P400.02	Run/Stop command	11	Assign the function to DI1 digital input (NC contact) (default)
P400.04	Reset fault (default: DI2)	0	Disable the function from DI2 digital input
P400.06	Start forward command	12	Assign the function to DI2 digital input (NO contact)

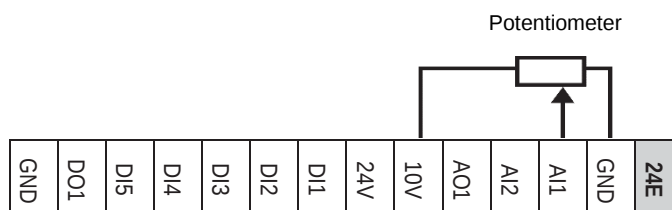
4. FREQUENCY REGULATION

4.1 From on-board Keypad



Parameter	Function	Value	Description
P201.01	Frequency setpoint source	1	Frequency regulation from Keypad
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time

4.2 From external potentiometer



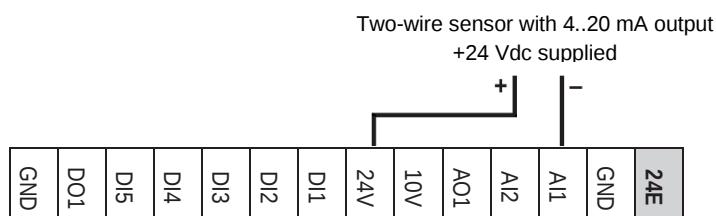
Parameter	Function	Value	Description
P201.01	Frequency setpoint source	2	Frequency regulation from AI1
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P430.01	Analog input 1: Input range	0	0-10 Vdc Analog signal
P430.02	Analog input 1: Min frequency value	0 Hz	Minimum frequency value (AI1 = 0 V)
P430.03	Analog input 1: Max frequency value	50 Hz	Maximum frequency value (AI1 = 10 V)

4.3 From 0-10 Vdc Analog signal

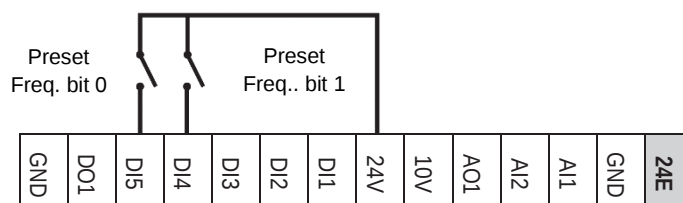


Parameter	Function	Value	Description
P201.01	Frequency setpoint source	2	Frequency regulation from AI1
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P430.01	Analog input 1: Input range	0	0-10 Vdc Analog signal
P430.02	Analog input 1: Min frequency value	0 Hz	Minimum frequency value (AI1 = 0 V)
P430.03	Analog input 1: Max frequency value	50 Hz	Maximum frequency value (AI1 = 10 V)

4.4 From 4-20 mA Analog signal



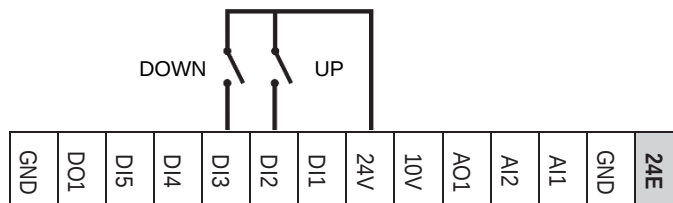
Parameter	Function	Value	Description
P201.01	Frequency setpoint source	2	Frequency regulation from Keypad
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P430.01	Analog input 1: Input range	4	4-20 mA Analog signal
P430.02	Analog input 1: Min frequency value	0 Hz	Minimum frequency value (AI1 = 4 mA)
P430.03	Analog input 1: Max frequency value	50 Hz	Maximum frequency value (AI1 = 20 mA)



DI5 (bit 1)	DI4 (bit 0)	Frequency Preset active
Open	Open	No Frequency setpoint Preset. Frequency is regulated from the source set in in P201.01
Open	Closed	Frequency setpoint Preset 1
Closed	Open	Frequency setpoint Preset 2
Closed	Closed	Frequency setpoint Preset 3

Table of the combinations of the Frequency Presets

Parameter	Function	Value	Description
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P400.18	Activate preset (bit 0)	14	DI4 = Frequency Preset active, bit 0 (default)
P400.19	Activate preset (bit 1)	15	DI5 = Frequency Preset active, bit 1 (default)
P450.01	Freq. preset 1	20 Hz	Frequency setpoint Preset 1 (DI4 closed)
P450.02	Freq. preset 2	45 Hz	Frequency setpoint Preset 2 (DI5 closed)
P450.03	Freq. preset 3	50 Hz	Frequency setpoint Preset 3 (DI4 and DI5 closed)



By MOP (motor potentiometer) we mean the possibility of regulating the frequency by means of two contacts on the terminal board, programmed respectively with the "MOP UP" (frequency increase) and "MOP DOWN" (frequency decrease) functions

Parameter	Function	Value	Description
P400.04	Reset fault (default: DI2)	0	Disable the function from DI2 input
P400.23	MOP UP	12	Assign MOP setpoint UP Function to DI2 input
P400.13	Reverse direction (default: DI3)	0	Disable the function from DI3 input
P400.24	MOP DOWN	13	Assign MOP setpoint DOWN Function to DI3 input
P400.25	Activate MOP setpoint	1	MOP uses ad Frequency setpoint
P413.00	MOP starting mode	0	Last value before the stop

4.7 Via Modbus® communication protocol - the corresponding Control Unit is required

Parameter	Function	Value	Description
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P400.37	Activate network control	1	Network control activated
P510.01	Node ID	1-255	Enter the Node ID
P510.02	Baud rate	4	19200 bps (example)
P510.03	Data format	1	8/E/1 (example, "8/E/1" means: 8 data bit, even parity, 1 stop bit)
P515.01	Response to time-out	0	No action

4.8 PID Function - Setpoint specified locally by the keypad and feedback signal type 0-10 V

Parameter	Function	Value	Description
P201.02	PID setpoint source	1	The setpoint is specified locally by the keypad
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P430.01	Analog input 1: Input range	0	0-10 Vdc Analog signal
P600.01	PID Operating mode	1	Normal operation (the motor speed is increased if the setpoint is higher than the actual value).
P600.02	PID feedback source	1	PID Feedback from AI1 Analog signal
P610.01	Condition for activating the PID sleep mode	1	PID sleep mode is activated when the frequency is lower than P610.03 for a time higher than P610.05
P610.03	PID sleep mode: Frequency threshold	35 Hz	See description of parameter P610.01
P610.05	PID sleep mode: Delay time	5 sec	See description of parameter P610.01

4.9 PID Function - Setpoint specified locally by the keypad and feedback signal type 4-20 mA

Parameter	Function	Value	Description
P201.02	Sorgente setpoint PID	1	Setpoint PID regolato da tastiera a bordo
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time
P430.01	Analog input 1: Input range	4	4-20 mA Analog signal
P600.01	PID Operating mode	1	Normal operation (the motor speed is increased if the setpoint is higher than the actual value).
P600.02	PID feedback source	1	PID Feedback from AI1 Analog signal
P610.01	Condition for activating the PID sleep mode	1	PID sleep mode is activated when the frequency is lower than P610.03 for a time higher than P610.05
P610.03	PID sleep mode: Frequency threshold	35 Hz	See description of parameter P610.01
P610.05	PID sleep mode: Delay time	5 sec	See description of parameter P610.01

5. MOTOR PARAMETERS



Parameter	Function	Value	Description
P208.01	AC Mains voltage	400 V	Set the rated mains voltage
P300.00	Motor control mode	4	Sensorless vector control (SLVC)
		6	V/f characteristic control (VFC open loop)
P302.00	V/f characteristic shape	0	Linear (Applications: conveyor belts, ...)
		1	Square-law (Applications: pumps, fans, ...)
P303.01	V/f base voltage	400 V	It is usually set to the rated motor voltage (P320.07)
P303.02	V/f base frequency	50 Hz	It is usually set to the rated motor frequency (P320.05)
P315.01	Slip compensation: gain	5%	Adjustment in percent of the slip calculated
P320.04	Rated motor speed	rpm	Set the rated motor speed
P320.05	Rated motor frequency	Hz	Set the rated motor frequency
P320.06	Rated motor power	kW	Set the rated motor power
P320.07	Rated motor voltage	V	Set the rated motor voltage
P320.08	Rated motor cosine phi	—	Set the rated motor cosine phi
P323.00	Rated motor current	A	Set the rated motor current. Setting this parameter also enables the thermal protection of the motor.

All other parameters must be left set with the factory defaults.

Automatic identification of the motor data

After manually setting the motor rated data, it is possible to perform automatic identification of the motor data, which allows you to optimize the motor control performance of the SINUS S. Requirements:

- The motor must be cold.
- All rated motor data are known and set in the SINUS S (see table above).
- The SINUS S is powered (DC bus voltage is available).
- The SINUS S is enabled, error-free and in the "Ready to switch on" or "Switched on" state.
- The motor is stopped (no start enable).
- No quick stop is active.

Procedure

- Request automatic identification: Set P327.04 = 1.
- Issue the start command to the SINUS S to start the procedure.

Parameter	Function	Value	Description
P327.04	Identify motor data (energized)	1	1 = Start automatic identification of the motor data. Note. During the procedure, the motor is energised!

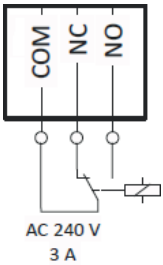
Once the procedure has started, SINUS S characteristics, motor equivalent circuit diagram data and controller settings are identified and set automatically. The procedure can take from a few seconds to a few minutes. During and after the procedure, the "RDY" LED (blue) remains on.

Once the procedure is complete, a new start command must be issued to start the motor.

6. ADDITIONAL FUNCTIONS

6.1 Relay output function configuration

To configure the relay output function with changeover contact (NO-COM-NC terminals) it is necessary to set parameter P420.01.

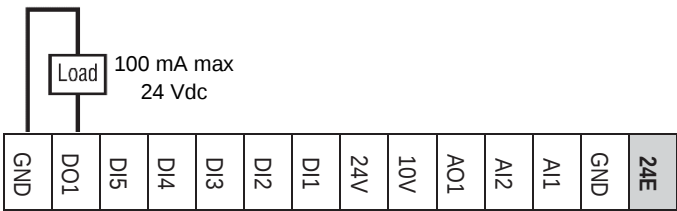


The most common setting examples are shown below.

Parameter	Function	Value	Description
P420.01	Relay output function	50	“Running”: TRUE if SINUS S and start are enabled and output frequency > 0.2 Hz.
		56	“Fault active”: TRUE if error is active.
		70	“Frequency threshold exceeded”: TRUE if current output frequency > frequency threshold set in P412.00.
		78	“Current limit reached”: TRUE if current motor current ≥ maximum current set in P324.00.

6.2 DO1 digital output function configuration

To configure the DO1 digital output function (DO1-GND terminals) it is necessary to set parameter P420.02.



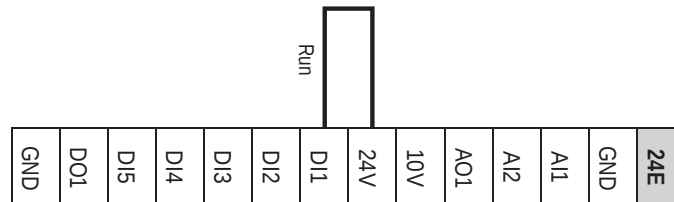
The most common setting examples are shown below.

Parameter	Function	Value	Description
P420.02	DO1 digital output function	50	“Running”: TRUE if SINUS S and start are enabled and output frequency > 0.2 Hz.
		56	“Fault active”: TRUE if error is active.
		70	“Frequency threshold exceeded”: TRUE if current output frequency > frequency threshold set in P412.00.
		78	“Current limit reached”: TRUE if current motor current ≥ maximum current set in P324.00.

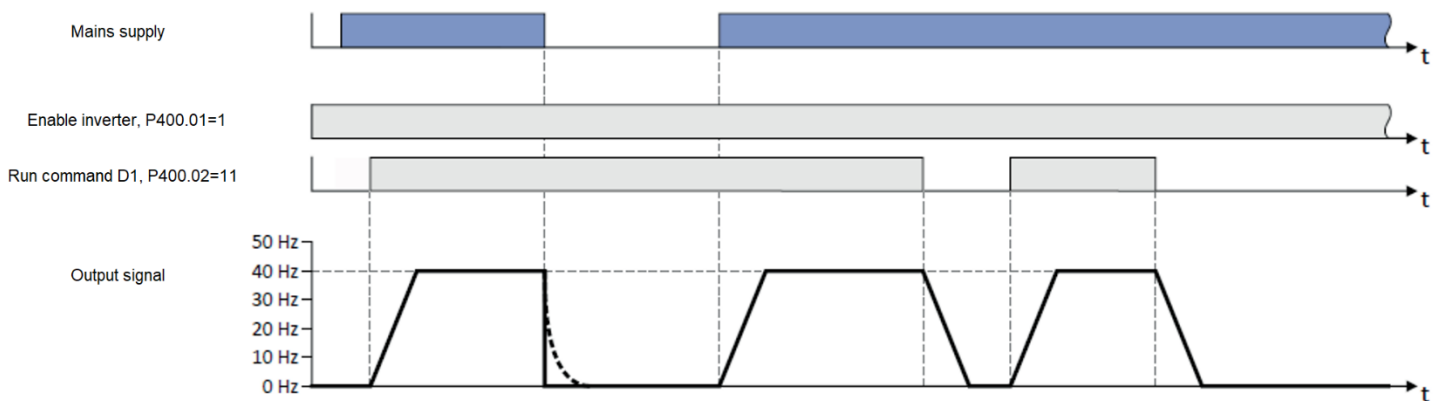
To configure the AO1 analog output function (AO1-GND terminals) it is necessary to set the following parameters.

Parameter	Function	Value	Description
P440.01	AO1 analog output function	1	0...10 VDC
		2	0...5 VDC
		3	2...10 VDC
		4	4...20 mA
		5	0...20 mA
P440.02	Selection of the signal to be shown at analog output 1.	1	Actual output frequency (resolution 0.1 Hz)
		2	Current frequency setpoint (resolution 0.1 Hz)
		3	Input signal of analog input 1 (resolution 0.1%)
		4	Input signal of analog input 2 (resolution 0.1%)
		5	Actual motor current (resolution: 0.1 A)
		6	Actual output power (resolution: 0.001 kW)
		7	Current torque (resolution: 0.1 %)
P440.03	Signal value that corresponds to the minimum value at analog output 1.	0	Example: if the analog output is configured as 4 ... 20 mA (P440.01 = 4), P440.03 is the signal value that corresponds to AO1 = 4 mA.
P440.04	Signal value that corresponds to the maximum value at analog output 1.	1000	Example: if the analog output is configured as 4 ... 20 mA (P440.01 = 4), P440.04 is the signal value that corresponds to AO1 = 20 mA.

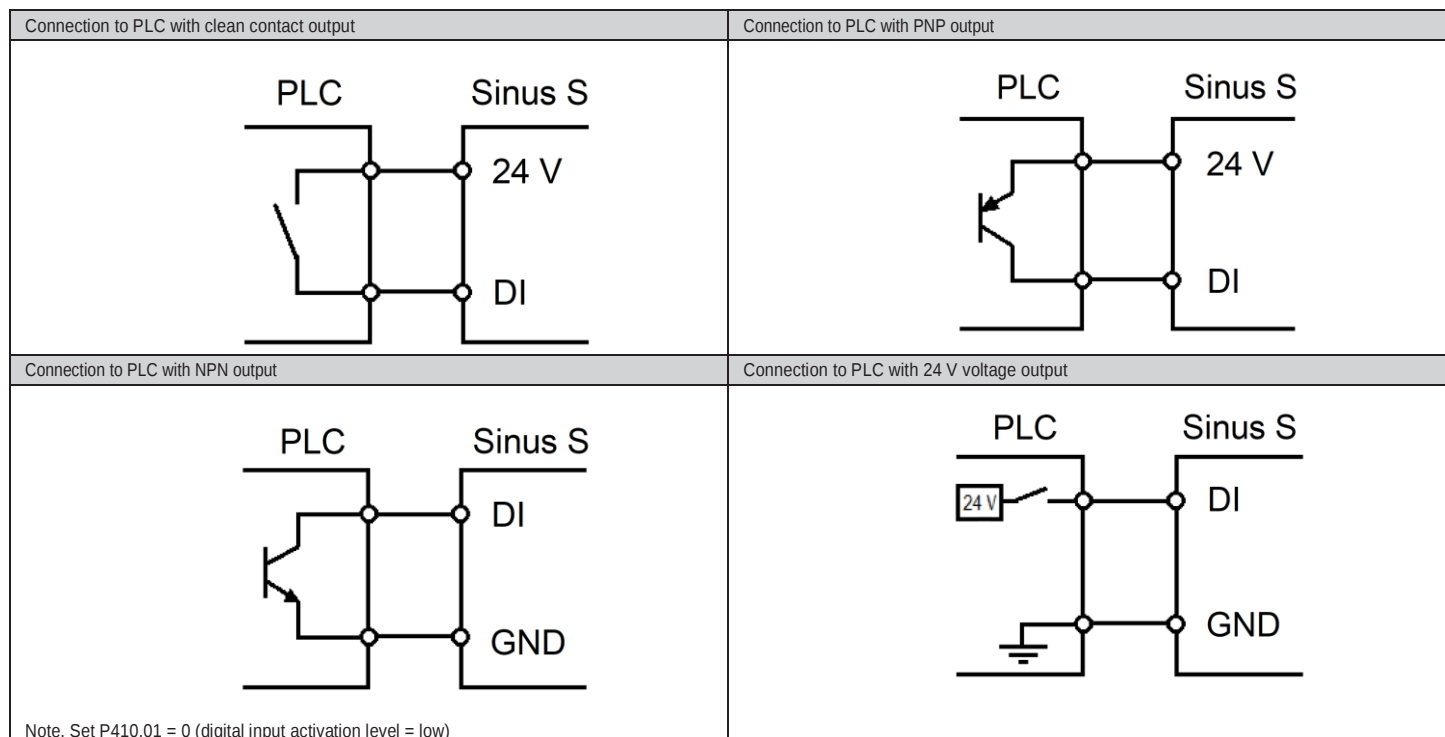
6.4 Enabling the Start at power-up function (AUTOSTART)



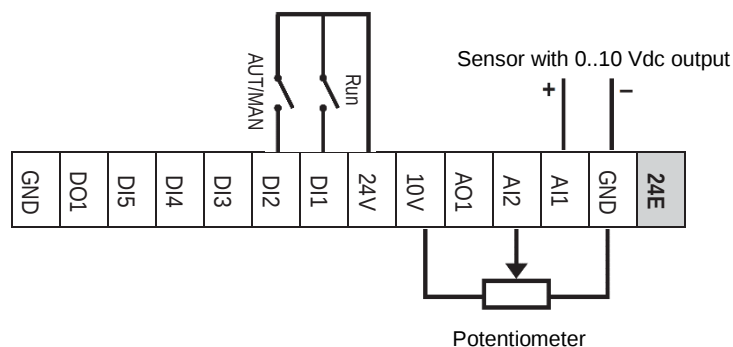
Parameter	Function	Value	Description
P203.02	Start at power-up (AUTOSTART)	1	Motor is started automatically when the SINUS S is powered up. Required conditions: - SINUS S is enabled. - Run function (P400.02) must be associated with a DI digital input and this must be kept closed to allow automatic restart.
P200.00	Control selection	0	The start / stop commands are managed by the terminal board.
P400.02	Run command	11	Run command from DI1 digital input.



Warning! This mode causes the automatic restart of the motor when the SINUS S is powered up. Verify that all safety requirements are met.



6.6 Automatic (PID) / manual (frequency regulation) operation management



The purpose of this programming is to manage the switching between two different operating modes on the SINUS S inverter via a digital input:

- Automatic mode (AUT): the inverter performs an automatic PID control
- Manual mode (MAN): the inverter is manually controlled in frequency

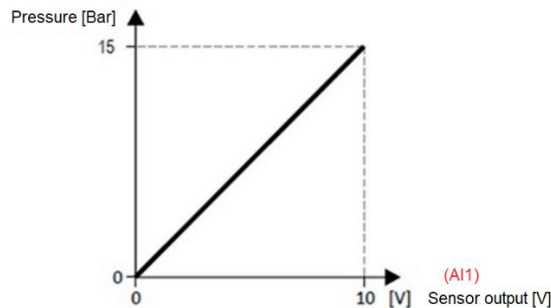
In this example, the following control inputs are used:

Input	Function
DI1	It commands the inverter to run, regardless of the selected mode (AUT / MAN).
DI2	It commands the passage between AUT and MAN modes: open = AUT, closed = MAN.

Automatic mode (AUT)

In Automatic mode the inverter works with PID control, where the PID setpoint is set from the on-board keyboard and the feedback is monitored by the analog input AI1.

In this example we have assumed to connect a pressure sensor with 0-10 V output to the analog input AI1, corresponding to a pressure of 0-15 Bar with a linear characteristic, as shown in the graph below.



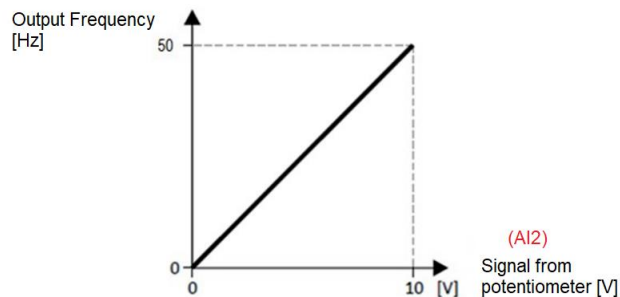
This means that if the sensor output is 0 V there is a pressure of 0 Bar, if the sensor output is 10 V there is a pressure of 15 Bar, if the sensor output is worth 5 V there is a pressure of 7.5 Bar and so on.

Furthermore, in this example we want to limit the setting of the PID setpoint between 2 Bar and 8 Bar.

Manual mode (MAN)

In Manual mode PID control is disabled and inverter frequency adjustment is done manually via a potentiometer connected to analog input AI2 (0-10 V type).

In this example we configure the inverter to provide an output frequency of 0 Hz when the potentiometer is at the minimum of its adjustment scale (0 V) and a frequency of 50 Hz when the potentiometer is at maximum (10 V).



Parameter	Function	Value	Description
P201.01	Frequency setpoint source	3	Frequency regulation from Keypad
P201.02	PID setpoint source	1	PID setpoint adjusted by on-board Keypad
P210.00	Minimum frequency	0 Hz	Set value for Minimum frequency
P211.00	Maximum frequency	50 Hz	Set value for Maximum frequency
P220.00	Acceleration time	5 sec	Set Acceleration time
P221.00	Deceleration time	5 sec	Set Deceleration time

I/O Configuration (AI1 = feedback PID, AI2 = frequency setpoint, DI1 = run, DI2 = change AUT-MAN modes)			
P430.01	Analog input 1: Input range	0	0-10 Vdc Analog signal
P430.04	Analog input 1: Min PID value	0	Minimum value of the AI1 signal expressed in PID (0 V = 0 PID unit, in this example corresponding to 0 Bar of pressure)
P430.05	Analog input 1: Max PID value	15	Maximum value of the AI1 signal expressed in PID (10 V = 10 PID unit, in this example corresponding to 15 Bar of pressure)
P431.01	AI2 input range	0	0-10 V analog signal
P431.02	Analog input 2: Min frequency value	0 Hz	Frequency value when AI2 is at its minimum (0 V)
P431.03	Analog input 2: Max frequency value	50 Hz	Frequency value when AI2 is at its maximum (10 V)
P400.02	Run command	11	Run command from DI1 digital input
P400.04	Reset fault (default: DI2)	0	Disable the function from DI2 digital input
P400.45	Deactivate PID controller	12	DI2 open = PID enabled, as long as P600.01 = 1 (AUT mode) DI2 closed = PID disabled (MAN mode)
PID control parameters configuration (AUT mode)			
P600.01	PID operating mode	1	PID enabled
P600.02	PID feedback source	1	PID Feedback from AI1 analog input
P600.05	PID Min speed limit	20%	Minimum value of the PID control working frequency expressed in % with respect to P211.00 (100% = P211.00 = 50 Hz) Example: 20% of 50 Hz = 10 Hz
P600.06	PID Max speed limit	80%	Maximum value of the PID control working frequency expressed in % with respect to P211.00 (100% = P211.00 = 50 Hz) Example: 80% of 50 Hz = 40 Hz
P605.01	PID Minimum setpoint	2	Minimum value of the PID set point that can be set, expressed in PID unit (in this example 2 PID Unit = 2 Bar of pressure)
P605.02	PID Maximum setpoint	8	Maximum value of the PID set point that can be set, expressed in PID unit (in this example 8 PID Unit = 8 Bar of pressure)
P606.01	PID acceleration time	10 sec	Enter the PID acceleration time
P606.02	PID deceleration time	10 sec	Enter the PID deceleration time

Example of use.

Once the parameters listed in the table have been set on the SINUS S, test the operation:

- Keep digital input DI2 open to enable automatic mode (AUT).



- Using the  buttons of the on-board keypad, set the PID setpoint, which for this example corresponds to a pressure setpoint. For example, set a setpoint of 4.0 PID Unit (= 4 Bar).
- The SINUS S monitors the system pressure value (PID feedback) from the analog input AI1, to which the pressure sensor output is connected. The 0-10V voltage signal supplied by the pressure sensor is automatically transformed by the SINUS S into a pressure value according to the previously set parameters (in this example: 0 V = 0 Bar, 10 V = 15 Bar).
- Close DI1 digital input to command the motor running.
- If the system pressure is lower than the set point (e.g. 2 Bar, which is lower than the 4 Bar set point), the SINUS S automatically increases the motor speed by adjusting the output frequency until a pressure equal to the value of setpoint. In this example, the output frequency with active PID control (AUT mode) is limited between 20% and 80% of the maximum frequency of the inverter (50 Hz), or between 10 Hz and 40 Hz.
- Close DI2 digital input to switch to manual mode (MAN).
- Now the PID control is disabled (the value of analog input AI1 is ignored). The inverter output frequency is adjusted manually with the external potentiometer, connected to analog input AI2. In this specific example, the frequency set with the potentiometer is adjustable from 0 Hz to 50 Hz.
- Open DI1 digital input to command the motor stop.

7. COMMON ERROR CODES

Parameter	Description	Cause	Remedy
0x2350	Motor Overload (I ² t)	Motor is thermally overloaded. Possible causes: - impermissible continuous current - frequent or too long acceleration processes.	- Check inverter sizing. - Check machine/driven mechanics for excessive load. - Check settings of the motor data. - Reduce values for slip compensation P315.01, P315.02 and oscillation damping P318.01, P318.02.
0x2320	Short circuit/earth leakage	Possible causes: - short circuit/earth fault of motor cable - capacitive charging current of the motor cable too high.	- Check motor cable. - Check length of the motor cable. - Use shorter or lower-capacitance motor cable.
0x2382	Ixt Error	Inverter utilisation (Ixt) too high by frequent or too long acceleration processes.	- Check inverter sizing. - Reduce the maximum current of the inverter P324.00. - In case of high mass inertias, reduce maximum current of the inverter P324.00 to 150%.
0x3210	DC bus overvoltage	DC-bus voltage has exceeded the error threshold for overvoltage due to - a too high braking energy or - a too high mains voltage. The error threshold P208.06 results from the setting of the rated mains voltage in P208.01.	- Reduce dynamic performance of the load profile. - Check mains voltage. - Check settings for brake energy management. - Connect brake resistor to the power unit and activate the integrated brake chopper: P706.01 = [0]. - Reduce parameter P315.01 (slip compensation) to 5%.
0x3220	DC bus undervoltage	DC-bus voltage has fallen below the error threshold for undervoltage. The error threshold P208.03 results from the setting of the rated mains voltage in P208.01.	- Check mains voltage. - Check DC-bus voltage P105.00 - Check mains settings P208.01. - Check fuses.
0x4210	Inverter overtemperature	The heatsink temperature of the power unit (display in P117.01) has exceeded the fixed error threshold (100 °C). Possible causes: - ambient temperature too high - fan or ventilation slots are polluted - fan is defective.	- Check mains voltage. - Provide for a sufficient cooling of the device. In case of a 100% load, 60 °C to +70 °C are normal. Display of the heatsink temperature in P117.01. - Clean fan and ventilation slots. If required, replace fan. - Reduce switching frequency P305.00.
0x4310	Motor overtemperature	The motor temperature sensor connected to terminals X109/T1 and X109/T2 measures a too high motor temperature. Possible causes: - impermissibly high currents - frequent and too long acceleration processes.	- Check inverter sizing. - Check motor temperature sensor and wiring: if the PTC sensor is not connected, a jumper must be connected between terminals T1-T2 or the motor temperature monitoring must be disabled by setting P309.02 = 0.