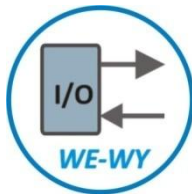


User manual

SID116



DC motor driver

with USB and RS485 – Modbus interfaces



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Thank you for selecting our product!

This instruction will help you at correct service and accurate exploitation of described device.

Information included in this instruction were prepared with high attention by our specialists and is description of the product. Based on the information should not be inferred a certain features or suitability for a particular application. This information does not release the user from the obligation of own judgment and verification.

P.P.H. WObit E.K.J. Ober s.c. reserves the right to make changes without prior notice.

-
- Please read instructions below carefully and adhere to its recommendation
 - Please pay special attention to the following characters:



CAUTION!

Not adhere to instruction can cause damage or impede the use of hardware or software.



CAUTION!

The warranty does not cover mechanical or electrical damages caused by overvoltage, short circuit and fault or break down caused by defective exploitation of the user/purchaser.

1. Safety and assembly rules

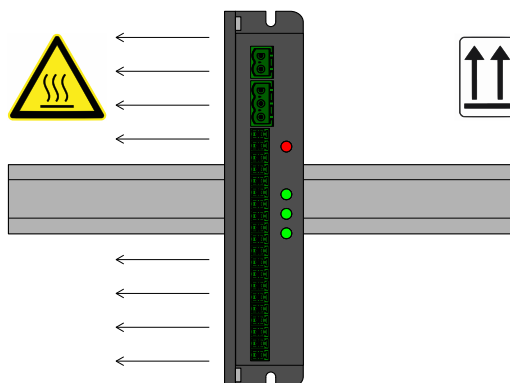
1.1 Safety rules

1. Prior to first start-up of the device please refer to this manual and keep it for further use.
2. Provide appropriate working conditions in compliance with the device specification (e.g.: power supply voltage, temperature, maximum current consumption).
3. Protect inside of the device from any liquids or elements – it can cause electric shock and damage of the device.
4. Basic features which knowledge and use will provide safe use consonant with its designation will be demonstrate on the device or in this manual.
5. The device with its parts is manufactured in way to provide its safe mounting and connection.
6. The device is designed and manufactured as to conform to the principles of protection against the threats mentioned above provided that the device is used in a manner consistent with its purpose and that it is properly maintained.
7. The device can cause interference of sensitive radio and television devices in nearby.

1.2 Assembly recommendation

It is recommended to follow measures described below to prevent any possible interruptions of the device operation:

- Do not power the driver on the same line as the device without a corresponding high power line filters (drivers/servo motors).
- Minimize influence of external interference.
- **To minimize noises** please use **screening** of the cable connecting motor with a driver. It is recommended to use a **ferrite bead** assumed on the motor wire in close to the driver.
- Encoder cable should be screened and shouldn't lead in close of motor cables.
- Signal cables **shouldn't lead in close to motor cables** and should be possibly short.
- While using servomotors supplied from the same power line please equip it in proper filters to eliminate noises which can influence on driver operation. Use of filters can be also necessary while occurring other noises from power line.



Picture. 1. Recommended mounting position

- While mounting it is recommended to keep proper driver position to provide proper heat dissipation. It is recommended mounting with space minimum 50 mm from next device to provide proper air circulation.

2. Introduction

2.1 Intended use

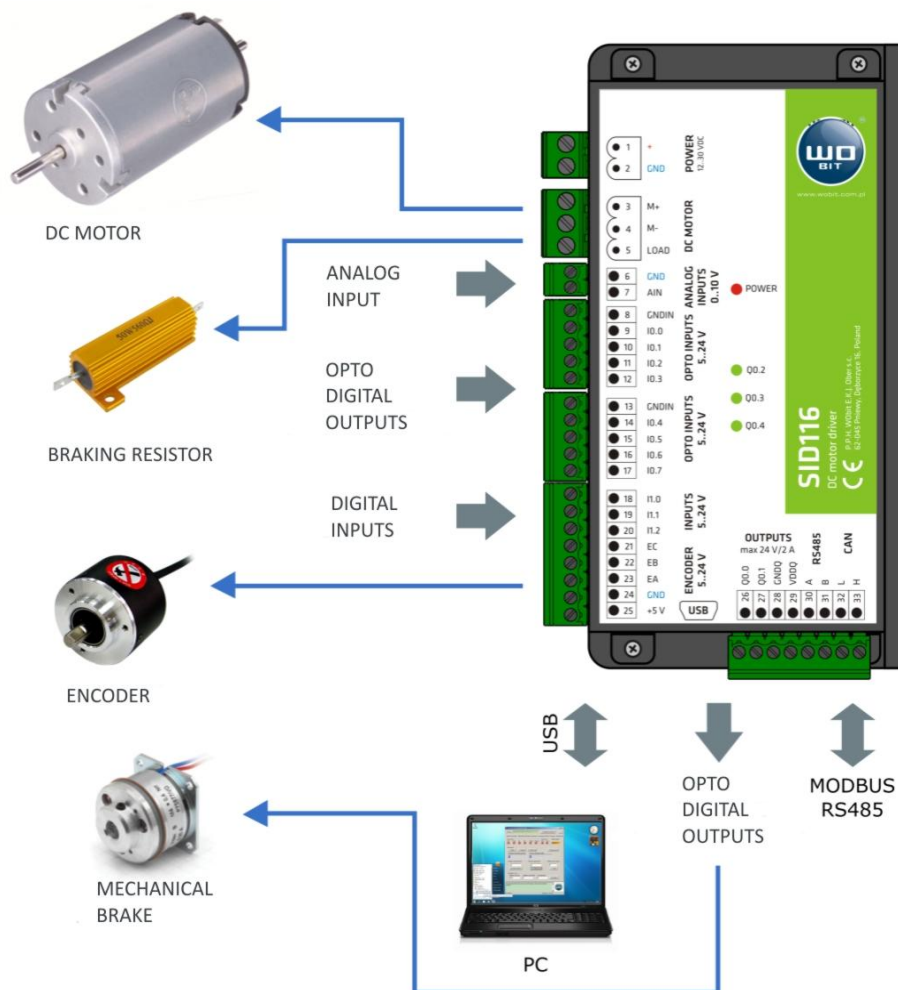
SID116 is a sophisticated DC motor driver which allows to control current, velocity, position and trajectory with symmetrical trapezoidal velocity profile. Driver allows motor control with direct current up to 16 A and voltage up to 30 V and 4Q operation (motor can operate as a drive or as generator depend on current load and rotation direction).

To driver can be connected an incremental encoder for position control. For precise homing can be used a C encoder channel connected to mechanical limit or to limit switch.

SID116 is equipped with dynamic braking function (based on internal resistor with option to connect an external resistance) and regenerative braking with configurable voltage limiting. It is also possible to connect a drive equipped with external brake with control current no bigger than 2 A.

Dedicated software enables easy configuration of driver operation modes and drive parameters using USB interface.

SID116 allows to assign settings (e.g. set position, velocity) directly to digital inputs at parallel/binary mode, operation using Modbus interface (RS485), control using analog input 0..10 V, STEP/DIR interface, tracking operation and position pulse regulation.



Picture. 2. Connection option of SID116 driver

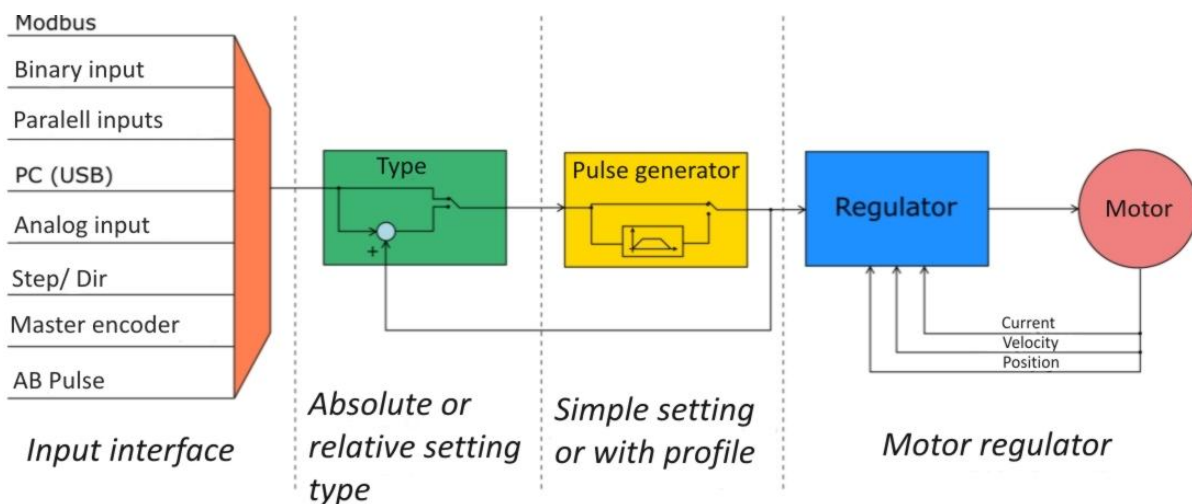
SID116 features:

- Maximal motor constant current up to 16 A,
- 11 digital inputs (8 opto insulated), including 2 fast inputs for connection of STEP/DIR interface, tracking encoder, control signals, do
- 2 opt insulated transistor outputs up to 2 A, 3 LED diodes,
- 1 analog input 0..10 V for setting velocity,
- Communication in MODBUS-RTU (RS485) protocol,
- Support of signals: ENABLE, STOP, DIR, BRAKE, LIMIT SWITCH, ERROR signalization/delete,
- Dynamic braking (resistor) / regenerative braking,
- USB connector for configuration,
- Thermal and overload protection.

2.2 Functions

Main function of SID116 driver is control of drive operation with DC motor driver according to selected regulation mode and control signal.

For each operation mode driver has independent memory of **16 settings**. Each setting consist in numerical value and type which defines if setting is **absolute** or **relative**. Absolute setting after selection is assigned directly to pulse generator input. Relative setting is assigned to driver input after sum with current value of pulse generator. All settings are saved in non-volatile memory.



Picture. 3. Block diagram

Activation of selected setting is made by indication of its index. Index can be selected by:

- **Modbus protocol** - after write its value to proper control register or using Jog command,
- **Driver input:**
 - **Binary** – values of individual inputs are treated as next index bits,
 - **Parallel** – input high state directly activate setting index assigned to it according to input priority,
- **PC application (USB).**

Driver allows also direct control of set value based on selected control interface. Then each change on interface input is transmitted to pulse generator input. User can use 4 control interfaces:

- **Analog input 0..10 V**
- **Step/Dir** – depend on Dir input state each signal slope cause setting increase or decrease by 1,
- **Master encoder** – square wave signal value on input is assigned directly to set value,
- **AB Pulse** – slope on A input cause increasing of set value by 1, slope on B input cause decreasing set value by 1.



Driver is equipped with 4 main operating modes:

Open loop (PWM) – set value is transmitted directly to power stage input as PWM duty with direction dependent on sign. Maximal current is limited according to settings,

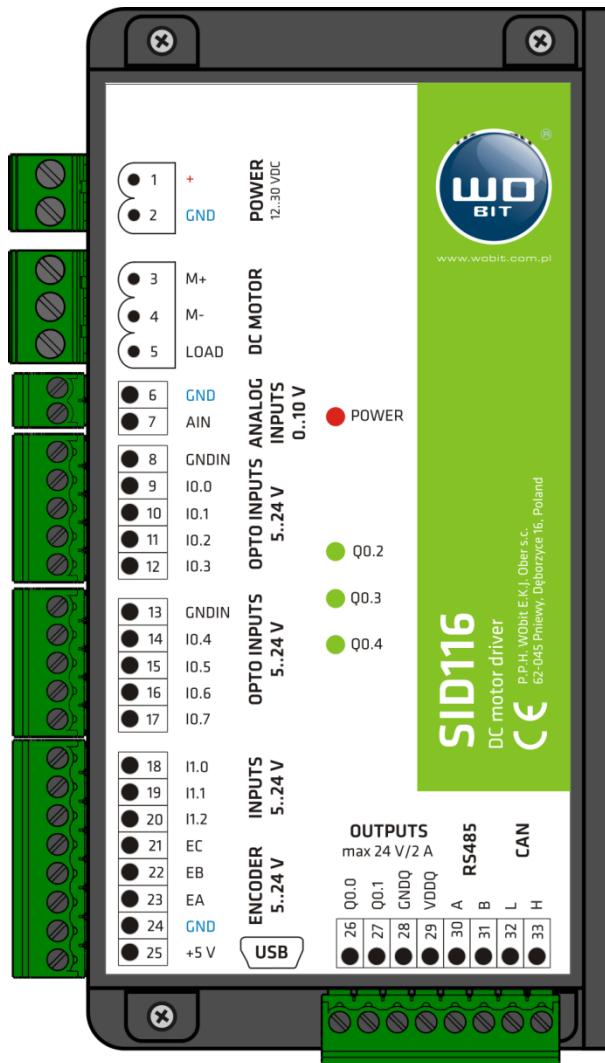
- **Current/torque adjustment:**
 - Current adjustment – value is set by current in milli amperes (mA),
 - Current adjustment with maximal speed limitation – value set by current in milli amperes (mA), maximal speed is limited according to settings (mode requires connection of encoder),
- **Velocity adjustment:**
 - Velocity adjustment – set value is velocity in revolutions per minute (rpm),
 - Velocity adjustment with profile – set value is velocity in revolutions per minute (rpm); acceleration, braking and maximal velocity are limited according to trapezoid velocity profile,
- **Position adjustment:**
 - Position adjustment – set value is position in encoder pulses (steps).
 - Position adjustment with profile – set value is position in encoder pulses (steps); acceleration, braking and maximal velocity are limited according to trapezoid velocity profile,
- **Mixed mode:** this mode is a mix of position adjustment and velocity with profile adjustment modes; this mode allows smooth changes between velocity and set position according to defined velocity profiles. Moreover at this mode velocity is expressed in pulses per second (steps/s) which allows velocity adjustment in range smaller than 1 rpm.

First two adjustment modes do not require position feedback. For correct current adjustment with velocity limit and all next modes it is necessary to connect driver of an **incremental encoder**. At position adjustment and all next modes it is possible drive homing based on C encoder channel and mechanical limit or limit switch.

Furthermore, irrespective of operation mode driver is equipped with **dynamic brake** function and braking energy recuperation function. While motor is at **generator operation** (motor shaft is driven by external mechanical system, e.g. as a result of inertia or gravity) the motor energy is returned to power supply e.g. to charge device battery. Excessive of energy is dissipated on internal resistor or on external in case of higher load.

3. Device description





3.1 Connectors and indicators arrangement



Picture. 4. SID116 indicators description

Table 1. SID116 connectors description

No	Name	Description	
1	VDC+	Power supply 12..30 VDC	Driver power supply
2	GND	Ground	
3	M+	Positive DC motor output	Motor
4	M-	Negative DC motor output	
5	LOAD	Control output of external braking resistor	
6	GND	Ground	Analog input
7	AIN	Analog input 0..10 V	
8	GNDIN	Signal ground I0.0 – I0.03 inputs	Digital inputs with opto insulation
9	I0.0	Programmable input	
10	I0.1	Programmable input	
11	I0.2	Programmable input	
12	I0.3	Programmable input	
13	GNDIN	Signal ground I0.4 – I0.07 inputs	Digital inputs with opto insulation
14	I0.4	Programmable input	
15	I0.5	Programmable input	
16	I0.6	Programmable input, interface input	
17	I0.7	Programmable input, interface input	
18	I1.0	Programmable input	Digital inputs without opto insulation
19	I1.1	Programmable input	
20	I1.2	Programmable input	
21	EC	Encoder C channel (index)	Incremental encoder
22	EB	Encoder B channel	
23	EA	Encoder A channel	
24	GND	Ground	
25	+5V	Output +5 V	
26	Q0.0	Programmable output	Digital outputs without opto insulation
27	Q0.1	Programmable output	
28	GNDQ	Output's ground	
29	VDDQ	Output's power supply	
30	A	RS485 A channel	Modbus RTU
31	B	RS485 B channel	
32	L	CAN L channel	CAN (not supported at 1.0 software version)
33	H	CAN H channel	

	POWER	Driver power supply signalization
	Q0.2	Programmable signal diode
	Q0.3	Programmable signal diode
	Q0.4	Programmable signal diode

3.2 Power supply

Driver power supply

Driver must be supplied with 12..30 V_{DC} voltage. For 24 V power supply current consumption is about 80 mA. Power supply should be connected to VDC+ and GND (1, 2) terminal. In case using of transistor outputs please consider current consumption for outputs.

+5 V output

Driver provides +5 V voltage which can be used as encoder supply (TTL type) or for potentiometers connected to AIN input. Maximal current consumption for all +5 V outputs shouldn't exceed **150 mA**.

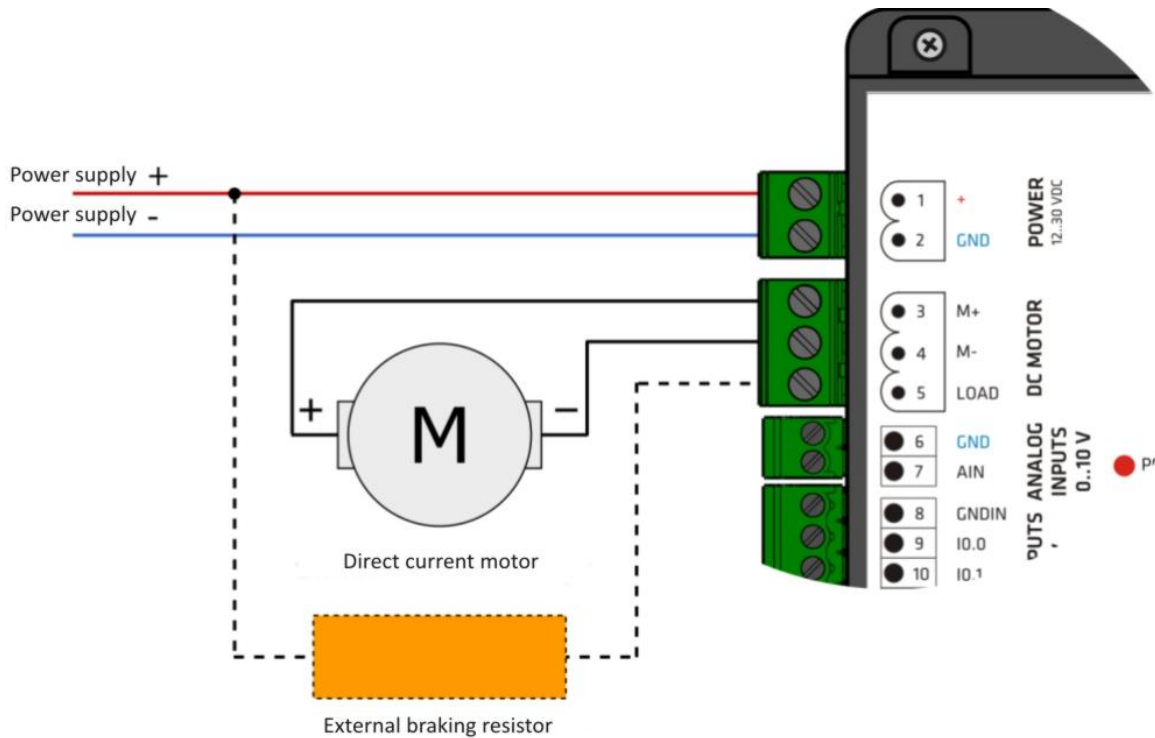


CAUTION!

Do not clench +5 V outputs with ground (GND) neither with power supply. It can cause damage of a driver. Please avoid leading cables with +5 V signal in close to other signal which can generate noises.

3.3 Motor and braking resistor

Driver allows connection of DC motors and braking resistor. Resistor is used to dissipate energy returned by motor as a result of change of rotational velocity. Driver is equipped with internal braking resistor with 10 Ω resistance and 10 W efficiency. In case of using a drive with high inertia it is possible to connect external resistance. For this aim is used LOAD (5) output, second end should be connected to driver supply VDC+ (1). Motor should be connected to M+(3) and M-(4)inputs, motor polarity can be important while use of drive with encoder.



Picture. 5. Motor connection diagram and additional braking resistor (as an option)



CAUTION!

After connection of external braking resistor please properly set power and resistance of resistor and driver power supply at SID116 – PC application. Lack of settings or entering wrong settings can cause damage of a drive.



It is recommended to use a ferrite bead on motor cables to eliminate noises from commutator.

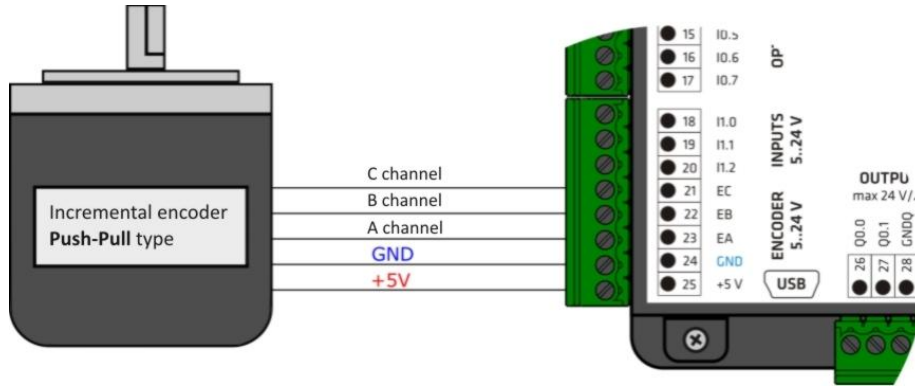


In case of drive with encoder its connection polarity force counting direction of encoder pulses.

3.4 Incremental encoder

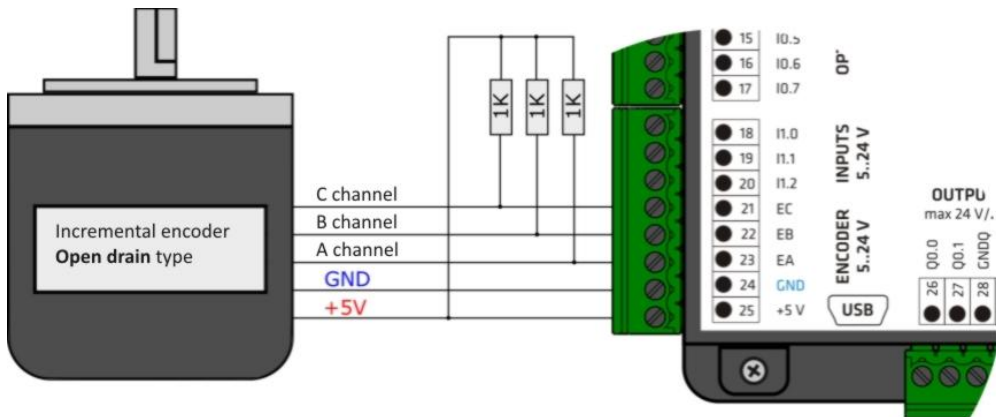
At velocity and position adjustment modes it is required to connect an encoder to the driver. SID116 allows connection of incremental encoder with operating voltage 5..24 V. Encoders with supply 5 V can be supplied directly from +5 V (25) output. Maximal output current efficiency is 150 mA.

Connection example of Push-Pull encoder type is presented below:



Picture. 6. Connection example of Push-Pull encoder type supplied from +5 V driver output

In case of encoder connection with power supply higher than 5 V encoder should be connected to external source of power supply. To driver please lead EA, EB, EC and GND signals, where GND is ground of encoder power supply. Maximal encoder pulses frequency shouldn't exceed 1 MHz. In case of encoder with Open Drain or Open Collector output type connection scheme is shown as following:



Picture. 7. Connection scheme of Open Drain/Open Collector encoder type supplied by +5 V driver output with use of pull-up resistors

Signal lines requires pulling-up by resistor to supply line. For +5 V power supply it is recommended to use 1 kΩ resistor. In case of 12.. 24 V encoder supply please use 2 kΩ resistor, to driver please lead EA, EB, EC and GND signals, where GND ground of encoder power supply. Maximal encoder pulses frequency shouldn't exceed 1 MHz.

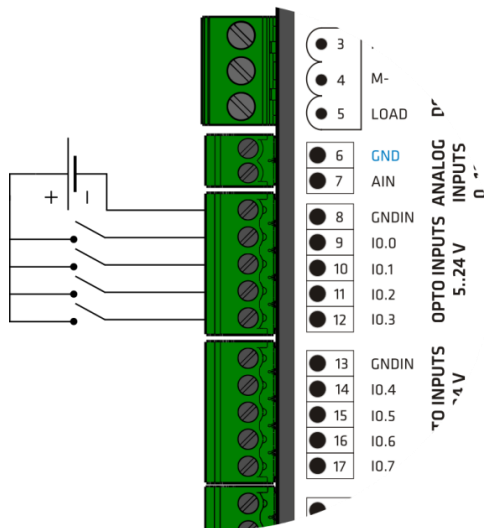


Position counting direction from encoder can be reverse by exchange line of A with B channel line

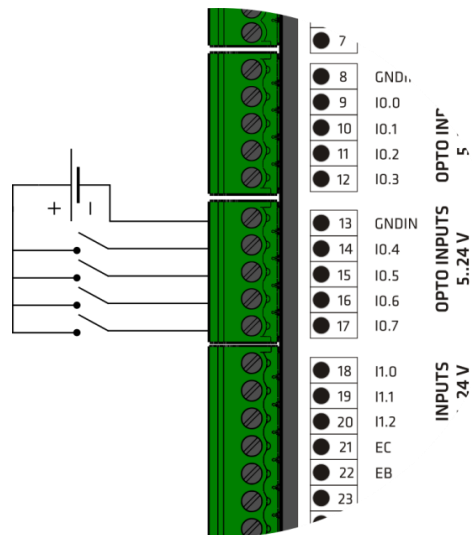
3.5 Programmable inputs

Programmable inputs allows connection of external control signal. Inputs are divided into:

- Inputs with opto insulation IN0.0 - IN0.7 – signal ground is separate
- Inputs without opto insulation IN1.0 - IN1.2 – signal ground is common with device supply ground.



Picture. 8. Inputs with opto insulation (IO.0 - IO.3)



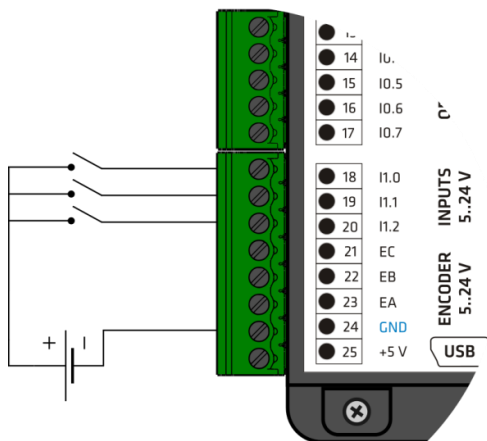
Picture. 9. Inputs with opto insulation (IO.4 - IO.7)

Parameters:

- Opto insulation
- High state: 24 V_{DC} (min 2 V, max. 26 V)
- Low state: < 2 V_{DC}

Parameters:

- Opto insulation
- High state: 24 V_{DC} (min 2 V, max. 26 V)
- Low state: < 2 V_{DC}
- Inputs IO.6 - IO.7 are also an interface inputs



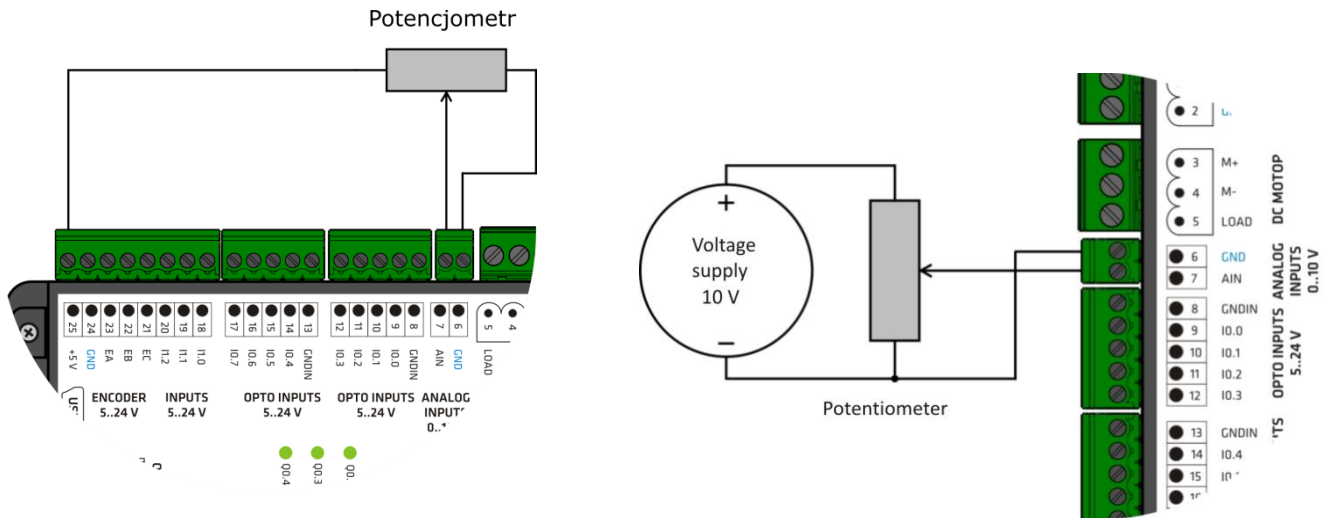
Picture. 10. Inputs without insulation (I1.0 - I1.2)

Parameters:

- None opto insulation, ground common with driver power supply ground
- High state: 24 V_{DC} (min 2 V, max. 26 V)
- Low state: < 2 V_{DC}

3.6 Analog input

Driver allows connection of external analog signal. Input can be used as velocity or position set point value.



Picture. 11. Analog input 0..10 V

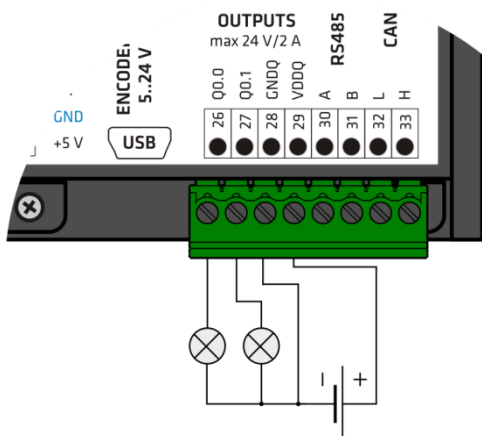
Driver's analog input range is 0..10 V. Input allows direct connection PLC driver with 0..10 V analog output. In case of analog input control using potentiometer to its supply can be used encoder supply output +5 V (25). Then input will be operate in its half range. To use full input range it is recommended use external stabilized power supply 10 V.



To minimize noises cables of analog signal should lead as far as possible from motor cables and braking resistor.

3.7 Programmable outputs

Driver is equipped with two programmable outputs with opto insulation. Before running of outputs please supply GNDQ (28) and VDDQ (29) terminals. Power supply should be in range 12..24 V.



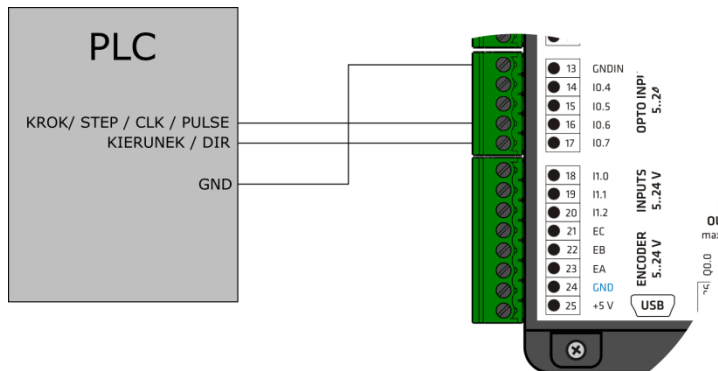
Picture. 12. Programmable output with opto insulation

Parameters:

- Opto insulation
- Constant load max 2 A at 24 V for channel
- Voltage range 12..24 V
- Build-in protection diode for inductive load

3.8 Control interfaces

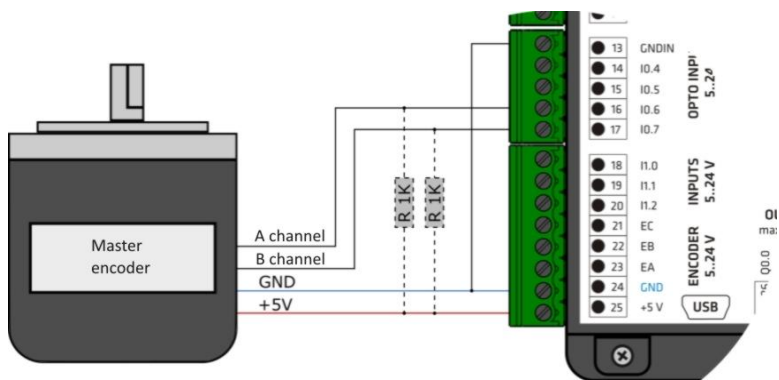
Driver allows connection of external interfaces using I0.6 (16) and I0.7 (17) fast inputs. Inputs operate as interface are not filtrated. Each pulse generated on input is counted by internal counting system and after counting is transmitted by control signal. Examples of interface signal configurations are presented below.



Picture. 13. Configuration example of fast inputs for step/dir signal

Parameters:

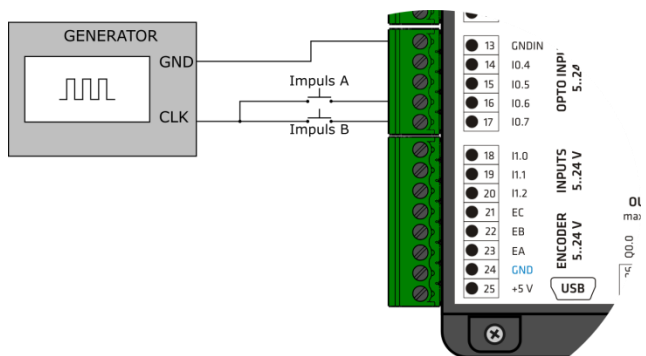
- Max signal frequency 200 kHz
- Voltage range 5..24 V
- Opto insulation



Picture. 14. Configuration example of fast inputs for master encoder signal

Parameters:

- Max signal frequency 1 MHz
- Voltage range 5..24 V
- For open drain/collector encoder types please use pull-up resistors
- Opto insulation



Picture. 15. Configuration example of fast inputs for A/B pulse signal

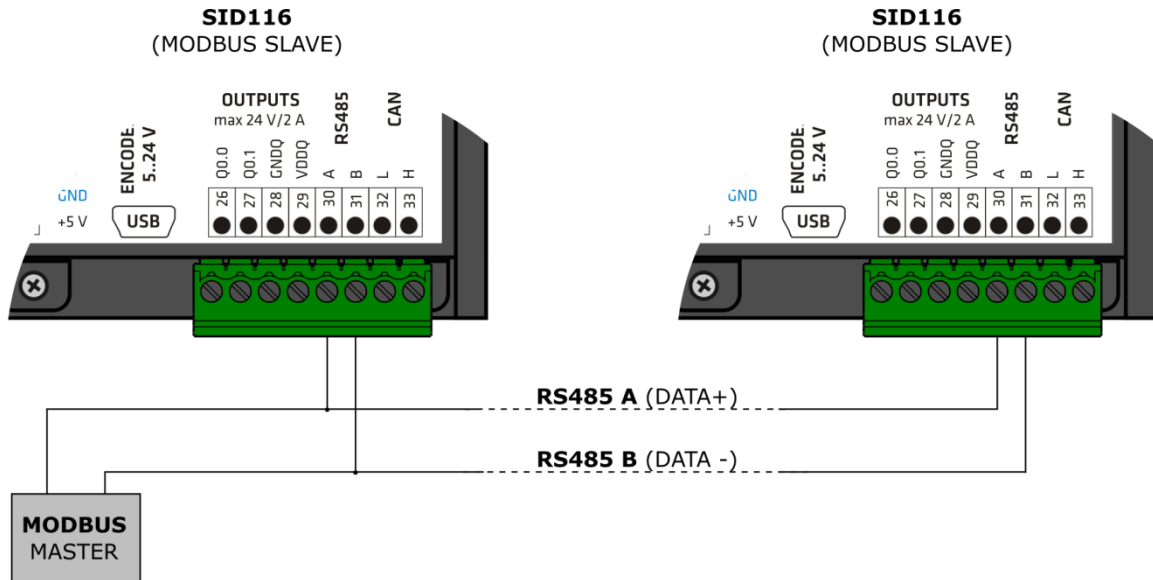
Parameters:

- Max signal frequency 200 kHz
- Voltage range 5..24 V
- Opto insulation

3.9 Communication interfaces

Driver allows communication at USB standard for driver parameters configuration by SID-PC application. SID116 is detected as standard HID type device, system drivers for communication are included in operation system.

SID is additionally equipped with MODBUS – RTU protocol on RS485 bus. Driver is operating as SLAVE device. Communication parameters can be adjusted using PC application. Device is equipped with internal RS485 (120Ω) line terminator.



Picture.16. Driver connection diagram to RS485 bus

Default communication parameters:

- Baudrate: **38400 bps**
- Stop bit: **1**
- Parity: **None**
- Frame: **8 b**
- Default address : **1**



Driver is equipped with build-in CAN interface (32, 33 derivations) but at current version protocol is not supported.

4. SID116 – PC software

4.1 USB connection with PC

Driver configuration and programming is made using SID116-PC application. Driver should be connected with PC using USB cable A – B mini type. After connection to computer please turn on driver power supply and run SID116 – PC program. Correct communication will be signaled by information at top program window.

CAUTION!

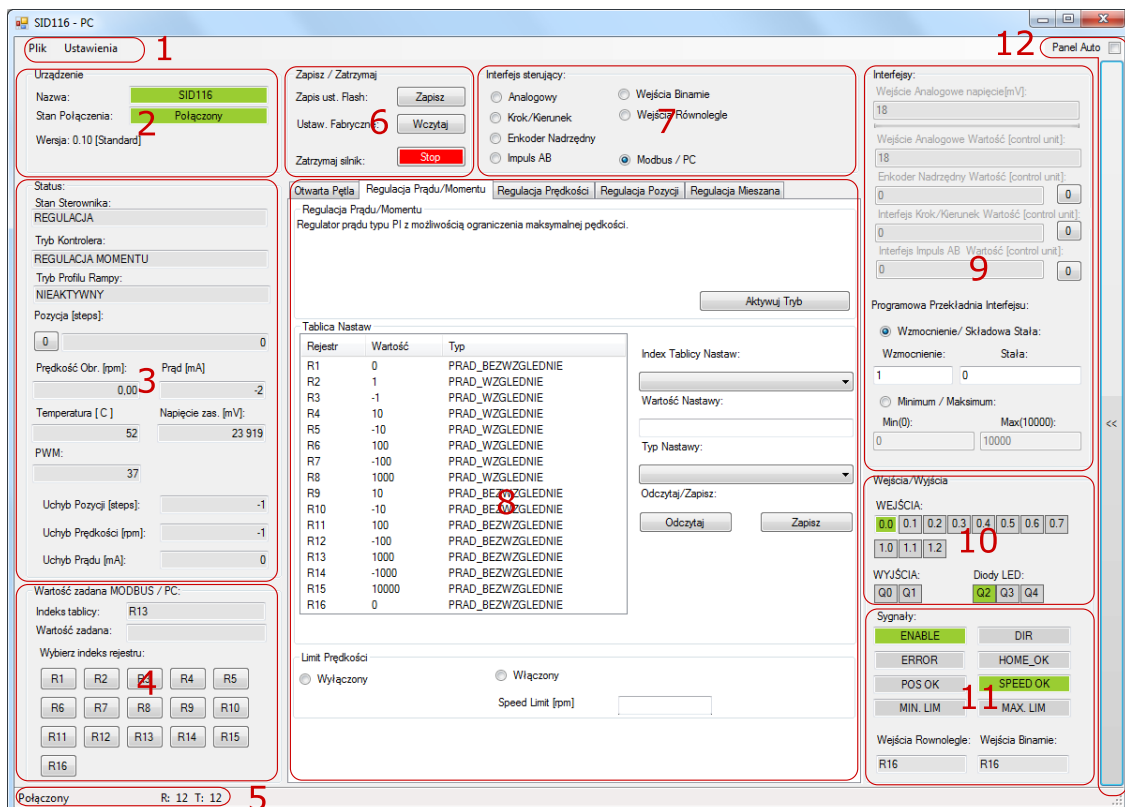


- 1) USB connection should be made always before turning on driver power supply.
- 2) USB connection is consistent to noises at supply line and to electromagnetic noises existing at industrial conditions. While occurring communication problems please use additional protecting elements like:
 - use line filters,
 - use high quality USB cable, <1,5 m length equipped with ferrite beads,
 - use opt insulated USB HUBS at PC side.

At higher noises can occur that communication will be impossible.

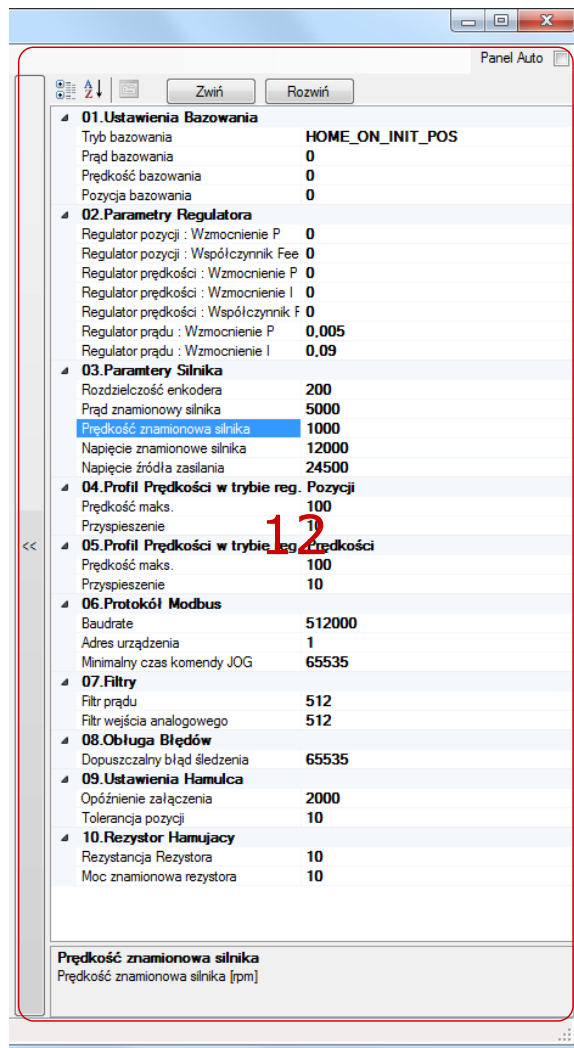
4.2 Application interface description

4.2.1 Main application window



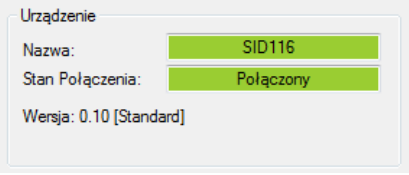
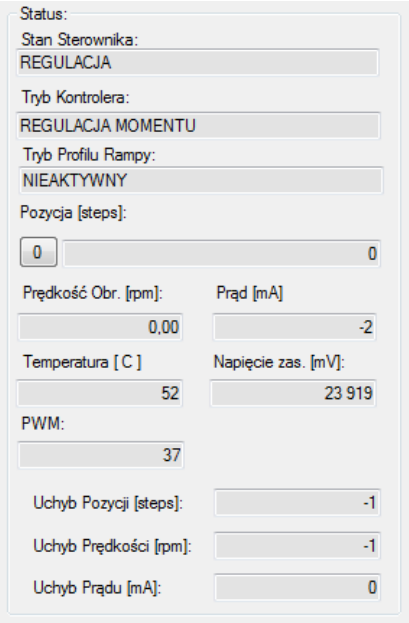
Picture. 17. Main application window

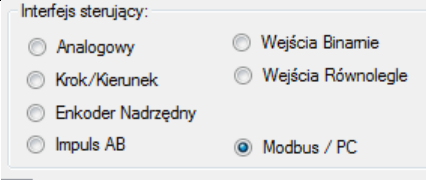
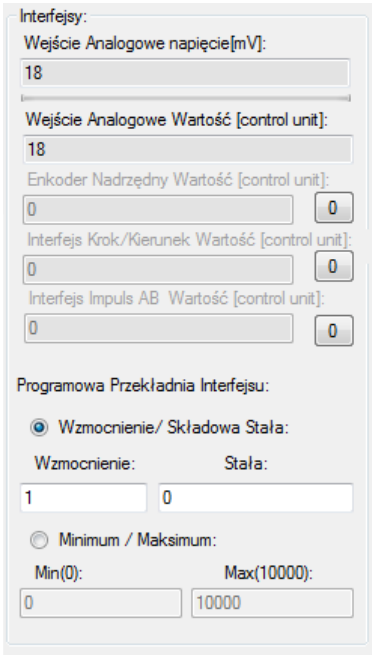
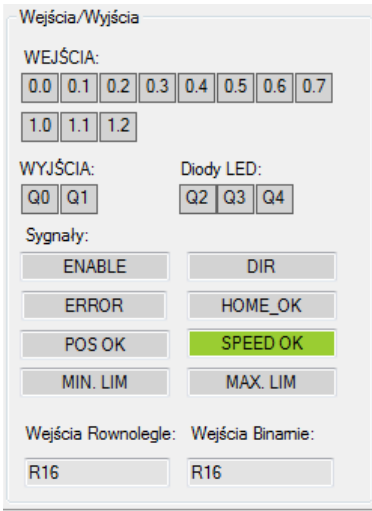
- 1) Toolbar.
- 2) Info about device
- 3) Driver current operation status
- 4) Tab allowing selection fo current Modbus register.
- 5) Communication status with PC
- 6) Settings Record / Read
- 7) Control interface selection tab
- 8) Regulation mode selection and setting edition tab
- 9) Current interface state and configuration tab
- 10) Driver I/O preview
- 11) Control signals preview
- 12) Advanced settings



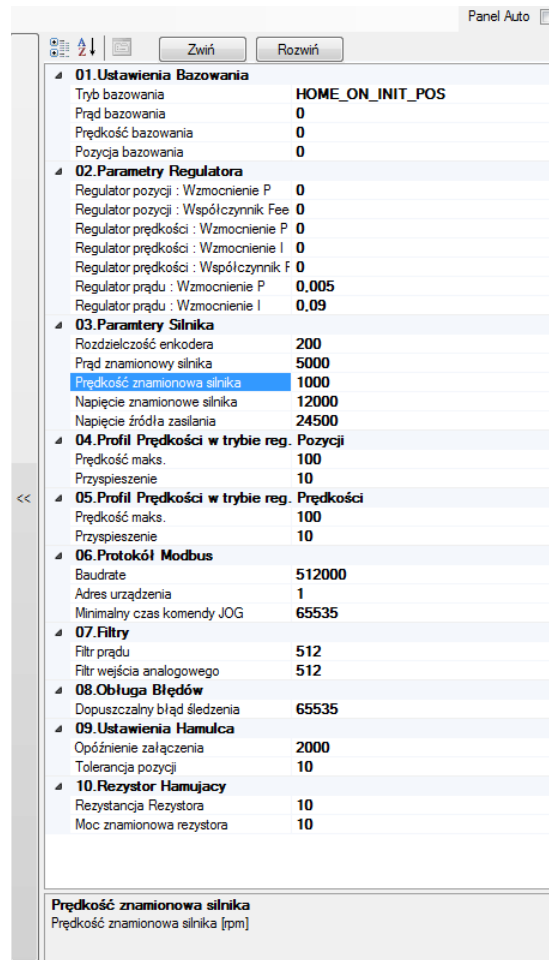
Picture. 18. Advanced settings panel

Table 2. Main window tabs description

Tab	Description
	<p>At this tab you can find information concerning type and status of connected device. When communication is correct name field and connection status field will be highlighted on green.</p> <p>Version field indicate driver current software version. Next to version number is presented name of modification. „Standard” name means standard factory software.</p>
	<p>At this tab is placed information concerning current parameters value. Driver status field can take following values:</p> <ul style="list-style-type: none"> INITIALIZATION – driver is running, enable signal disabled, HOMING – driver execute homing procedure, REGULATION – driver operate according to current settings, driver is active, ZATRZYMANE – driver is stopped, emergency stop signal is active BŁĄD/AWARIA – driver error, drive is not active <p>Driver mode field is presenting driver current operation mode. Mode field of ramp profile can take values as below:</p> <ul style="list-style-type: none"> NIEAKTYWNY – profile generator is not active BŁĄD – profile can't be determined for given parameters OBLICZANIE PROFILU – driver counts parameters PROFIL:PRZYSPESZANIE – drive acceleration PROFIL:STAŁA PRĘDKOŚĆ – drive after acceleration is moving with constant velocity according to profile (trapezoid) PROFIL:HAMOWANIE – drive braking PROFIL:ZAKOŃCZONY – drive executed motion and waits for next setting PROFIL:ZAKOŃCZONY/STAŁA PRĘDKOŚĆ – drive achieved set velocity and moves with its value <p>Position field is presenting current drive position in steps which corresponds to single encoder increment. Position can be reset at anytime by pressing „0” reset button.</p> <p>Velocity field is presenting averaged driver velocity (averaging with period 100 ms.)</p> <p>Current field indicates topical current supplied to motor in mA. Value is averaged according to cyclic filter set at advanced settings tab (12).</p> <p>Temperature field indicates current driver temperature at Celcius degrees.</p> <p>Supply voltage field indicates driver voltage supply in mV.</p> <p>PWM field indicates current power transmitted to driver in % * 10.</p> <p>Position error field indicates current position error in steps (difference between set position and current position).</p> <p>Velocity error indicates current position error at [rev./min] (difference between set velocity and current velocity).</p> <p>Current error field indicates topical current error in mA (difference between set current and topical current).</p>
	<p>Zapisz button – save all driver settings to non-volatile memory.</p> <p>Wczytaj button – read driver factory settings.</p> <p>Stop button – allows drive stop.</p>
	<p>Selection tab of control interface allows to select source of control signal:</p> <ul style="list-style-type: none"> Analog - control using analog input. Step/Dir – control using step/dir interface. Master encoder – tracking operation, tracking external signal of encoder. AB pulse - pulse control mode. Binary inputs – control using digital inputs with binary counted value to setting index.

	<ul style="list-style-type: none"> Serial inputs – control using digital inputs with value counted to setting index (individual input activates directly ascribed index). Modbus/PC – control by PC application or Modbus RTU protocol by setting index selection.
	<p>Interface tab presents current value of selected interface.</p> <p>Analog input field – presents current voltage at driver analog input in milivolts (mV)</p> <p>Analog input field presents current value of analog input converted by Interface coefficients.</p> <p>Master encoder value field – displays value of master encoder converted by Interface coefficients. Next to this field is located a reset button.</p> <p>Step/Dir field – displays value of step/dir interface converted by Interface coefficients. Next to this field is located a reset button.</p> <p>AB pulse field – displays value of pulse interface converted by Interface coefficients. Next to this field is located a reset button.</p> <p>Interface coefficients – is conversion of interface value by linear function. There are available two conversion modes:</p> <ul style="list-style-type: none"> Gain/Constant coefficient mode – means direct entering of coefficients Minimum/Maximum mode – means giving value which will be indicated for 0 and for 10 000 value. <p>Gain field allows to enter control interface amplification (floating point value). Entered value should be confirmed by pressing ENTER button.</p> <p>Constant coefficient field allows to enter constant coefficient of control interface (floating point value). Entered value should be confirmed by pressing ENTER button.</p> <p>Minimum field allows to enter control interface value (floating point value) at 0 point. Entered value should be confirmed by pressing ENTER button.</p> <p>Maksimum field allows to enter control interface value (floating point value) at 10 000 point. Entered value should be confirmed by pressing ENTER button.</p>
	<p>I/O tab displays inputs state and allows to control its state.</p> <p>Inputs buttons 0.0 – 0.7, 1.0 – 1.2 – displays status of proper driver inputs. Pressing of the button cause enforcing inputs high state. Enforcing settings are saved to non-violate memory and allows to activate input while driver start-up.</p> <p>Q0 – Q4 buttons – displays status of proper driver outputs. Pressing of the button cause enforcing outputs high state. Enforcing settings are saved to non-violate memory and allows to activate output while driver start-up.</p> <p>Signal fields allows to display values of selected signals.</p> <p>Parallel inputs field indicates index indicated by index inputs at parallel mode.</p> <p>Binary inputs field indicates by index inputs at binary mode.</p>

4.2.2 Advanced settings.



Picture. 19. Advanced settings panel

At this window are located driver parameters divided into 10 groups. Each group parameter is stored at non-volatile driver memory.

Settings record is made by pressing save button at main application window. Each parameter has description displayed after pressing name of the parameter. Entering of a parameter should be confirmed by pressing ENTER button.

Panel Auto indicator activates auto-hide function of advanced settings section.

Collapse button hides parameters of selected setting groups.

Expand button expands parameter groups to show available parameters.

Table 3. Advanced parameters description

Parameter	Description
01.Homing settings	
Homing mode	Available modes: HOME_ON_INIT_POS – homing turned on, only position reset HOME_ON_CURRENT – homing after exceeding homing current HOME_ON_ZERO_SPEED – homing up to occurring drive velocity = 0 HOME_ON_MIN – homing, limit switch connected to MIN_LIM input HOME_ON_ENC – homing to encoder C channel HOME_ON_CURRENT_AND_ENC – homing up to exceeding of maximal current, then to encoder C channel HOME_ON_ZERO_SPEED_AND_ENC – homing up to zero velocity, then to encoder C channel HOME_ON_MIN_AND_ENC – homing to MIN_LIM input, then to encoder C channel.
Homing current	Maximal current while homing in mA
Homing velocity	Homing velocity in rpm
Homing position	Position after homing – drive after homing will execute movement to set position (only positive values)
02. Regulator parameters	

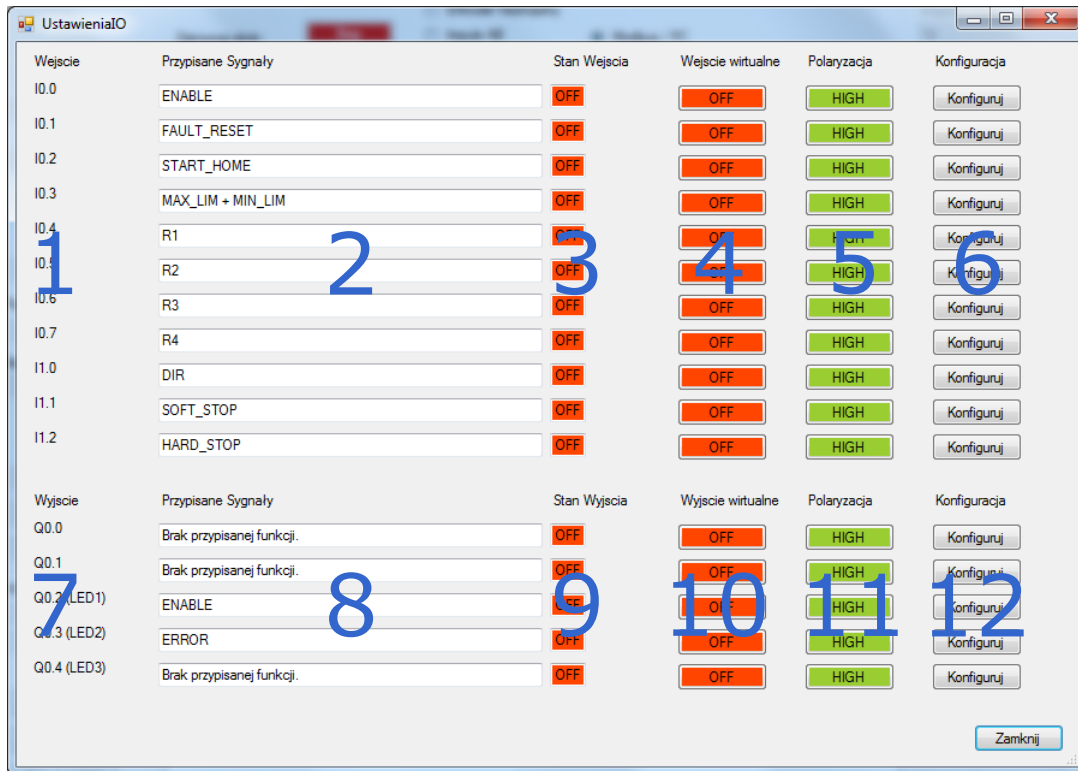
Position regulator: P gain	Gain of position regulator proportional constant
Position regulator: Position Feed Forward Coefficient	Position Feed Forward Coefficient
Velocity regulator: P gain	Gain of velocity regulator proportional constant
Velocity regulator: I gain	Gain of velocity regulator integral constant
Velocity regulator: Velocity Feed Forward Coefficient	Feed Forward Coefficient
Current regulator: P gain	Gain of current regulator proportional constant
Current regulator: I gain	Gain of current regulator integral constant
03. Motor parameters	
Encoder resolution	Resolution of encoder mounted on motor shaft (rated value without square wave)
Motor rated current	Motor rated current (driver will limit maximal current to this value) in mA
Motor rated velocity	Motor rated velocity (driver will limit maximal velocity to this value) in rpm
Motor rated voltage	Motor rated supply voltage (driver will limit maximal voltage to this value) in mV. Value can't be higher than power supply voltage value
Power supply voltage	Driver's PSU output voltage in mV. Above this voltage driver starts braking/ energy recovery. Value taken under consideration while determining motor voltage limit. Please enter voltage maximal value i.e. while accumulator supplying please enter voltage for completely charged accumulators, in case of adapter please measure existing voltage.
04. Velocity profile at position regulation mode	
Maximal velocity	Driver maximal velocity limitation in rpm
Acceleration	Acceleration / Profile braking in rps^2
05. Velocity profile at velocity regulation mode	
Maximal velocity	Driver maximal velocity limitation in rpm
Acceleration	Acceleration / Profile braking in rps^2
06. Modbus protocol	
Baudrate	Baudrate in bps. Max 115 200
Device address	Device address at Modbus protocol
Minimal time of JOG command	Time of keeping JOG command by Modbus. Command will be run on time defined in $x * 10ms$
07. Filters	
Current filter	Motor averaged current filter (homing mode, displayed current) please enter sample number 1..1024. Filter is moving average filter with 18 kHz frequency.
Analog input filter	Analog input filter, please enter sample number 1..1024. Filter is moving average filter with 1 kHz frequency.
08. Error handling	
Allowable tracing error	Allowable position error, Triggering threshold of position tracking error in steps
09. Mechanical brake settings	
Activation delay	Time between achieving correct position and activation of brake (ms)
Position tolerance	Allowable position error, brake activation threshold in steps
10. Braking resistor settings	
Resistor resistance	Braking resistor resistance in ohms (Ω)
Resistor rated power	Braking resistor rated power (W)



All parameter changes in advanced settings tab requires confirmation by ENTER button. Permanent settings record requires pressing Save button at main application window.

4.2.3 I/O configuration.

All SID116 driver I/O are mappable i.e. for any I/O there is a possibility to ascribe any signal from allowable signal range. Moreover for each I/O can be independently configured its polarity. I/O configuration window is available at application menu -> Settings -> I/O configuration.

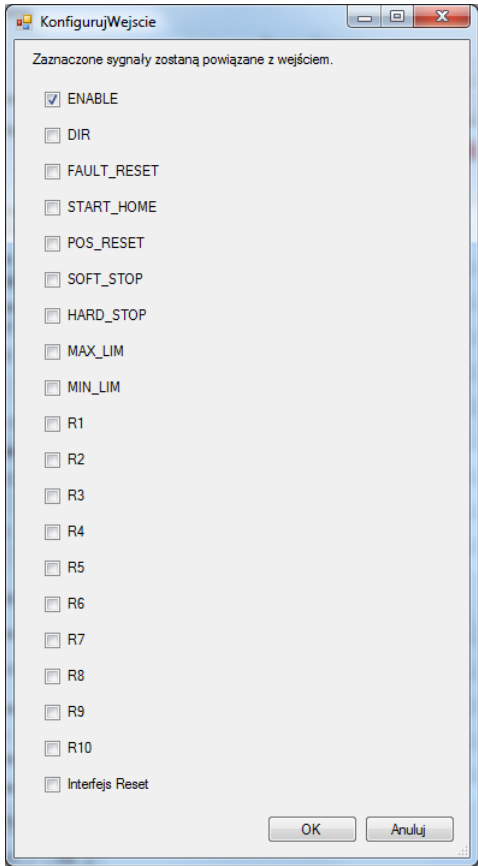
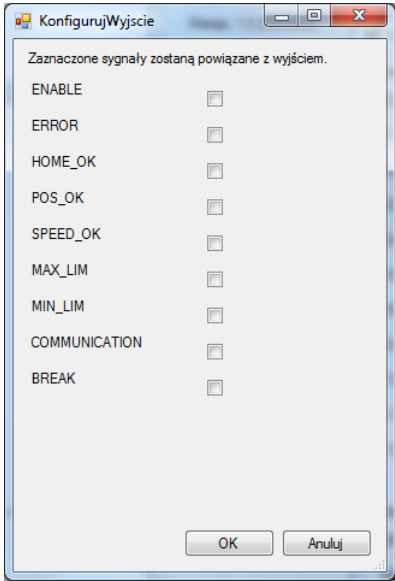


Picture. 20. I/O configuration window

Parts of I/O configuration window:

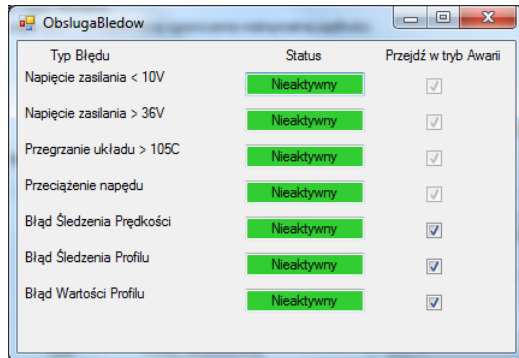
- 1 – Number of driver input
- 2 – Signals assigned to input, signals on input can be connected on base logical disjunction (by one input can be triggered several signals)
- 3 – Input logical state
- 4 – Virtual input – enforcing current input state:
 - ON – enforcing input active state
 - OFF – enforcing not active
- 5 – Input polarity:
 - HIGH – high state on driver input corresponds to active signal
 - LOW – low state on driver input corresponds to active signal
- 6 – Configuration of signals assigned to input
- 7 – Number of driver output
- 8 – Signals assigned to output
- 9 – Output logical state
- 10- Virtual output, enforcing current output state:
 - ON – enforcing output active state
 - OFF – enforcing not active
- 11 – Output polarity:
 - HIGH – active signal state corresponds to high state on output
 - LOW – active signal state corresponds to low state on output
- 12 – Configuration of signals assigned to output

Table 4. Signals available for inputs and outputs

	<p>Available signals for inputs:</p> <p>ENABLE – drive operation enable signal DIR – drive rotation direction FAULT_RESET – reset of driver errors START_HOME – starts drive homing POS_RESET – Reset of current position SOFT_STOP – Soft stop HARD_STOP – Instantaneous stop MAX_LIM – positive limit switch MIN_LIM – negative limit switch R1 – Index input of R1 setting R2 – Index input of R2 setting R3 – Index input of R3 setting R4 – Index input of R4 setting R5 – Index input of R5 setting R6 – Index input of R6 setting R7 – Index input of R7 setting R8 – Index input of R8 setting R9 – Index input of R9 setting R10 – Index input of R10 setting INTERFEJS_RESET – Position reset of external interface (Step/Dir etc.)</p>
	<p>Available signals for outputs:</p> <p>ENABLE – signalisation of active drive ERROR – drive at emergency state HOME_OK – homing finished POS_OK – set position achieved SPEED_OK – set velocity achieved MAX_LIM – active positive limit switch MIN_LIM – active negative limit switch COMMUNICATION – Signalization of receiving Modbus frame BREAK – Control signal of mechanic brake</p>

4.2.4 Driver error handling.

Error handling window is available at main application window -> Settings -> Error handling.



Picture. 21. Errors handling window

User can configure errors .

At first column window is located error name.

Second column informs about error status:

- Not active – error is not active
- Active – is active, depend on settings it can cause drive stop and emergency mode.

Third window column allows to select if error will cause emergency mode. First four errors are a critical errors and can't be deactivated.

5. Driver configuration

5.1 Commissioning



CAUTION!

While commissioning please follow rules included at this chapter and please respect order of mentioned actions.

5.1.1 Software update.

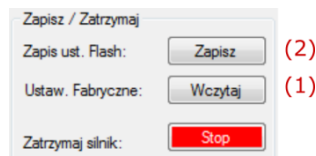
Before commissioning it is recommended to download the latest software from www.wobit.com.pl.

At catalogue with software is placed SID116–PC application used for driver configuration and current version of driver firmware with FirmwareUpdater.exe program for its update.

Before commissioning please update firmware according to manual included in catalogue.

5.1.2 Driver commissioning step by step.

- I Please connect driver power supply, then connect driver to PC using USB cable. Other I/O leave not connected. At first connection to computer drivers of operational system will install automatically. Please wait until its finish.
- II Start SID116 – PC application.
- III Read in default settings (1) and save settings (2). After record driver will restart which will be signaled by LED diode blinking on front panel.



- IV Go to advanced settings tab to configure drive parameters:

03. Parametry Silnika	
Rozdzielczość enkodera	0
Prąd znamionowy silnika	1000
Prędkość znamionowa silnika	0
Napięcie znamionowe silnika	30000
Napięcie źródła zasilania	30000

- Enter resolution of encoder mounted on motor shaft. Resolution is given without considering square wave signal. If encoder is not included leave this value without changes.
- Enter motor rated current in mA
- Enter rated velocity if drive uses encoder
- Enter motor rated voltage in mV
- **Enter voltage supply in mV**



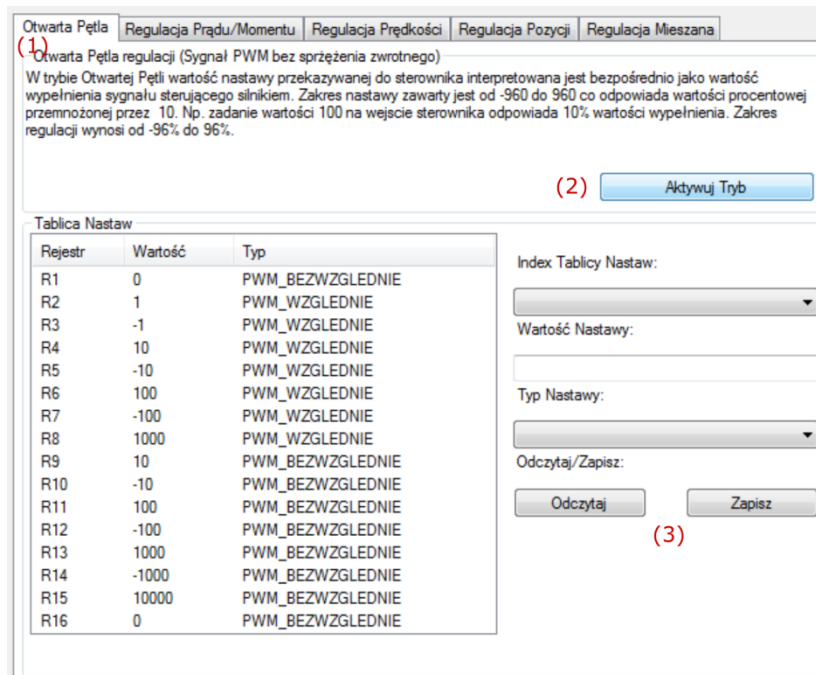
While commissioning can be entered lower value of rated current e.g. 10-25% of rated value. It allows to limit motor torque.



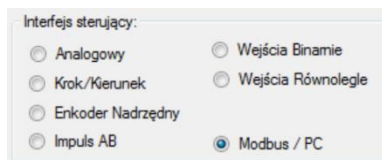
CAUTION!

Entered power supply source voltage can't be lower than existing maximal voltage supplied by power supply source. Wrong entering of parameter can damage the driver!

- V Set driver to operation at open loop. Please select „Open loop” sheet (1). Then press „Activate mode” (2). Settings can be edited by pressing selected setting and change its value at form located on the right (3).

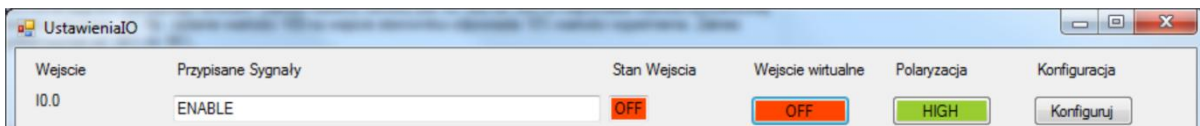


As control interface please select Modbus/PC option.



VI To start the driver it is necessary to connect ENABLE signal to input. Input configuration is located at I/O configuration window (check 4.2.3 chapter). By default ENABLE signal is connected to IO.0 input. It is recommended to connect stop signal (HARD_STOP) when drive is coupled to mechanical load.

VII



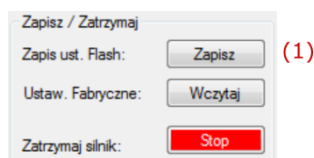
VIII When motor is equipped with mechanical brake it must be configured. Outputs configuration is located at I/O configuration window (check 4.2.3 chapter). Below is presented configuration for NC brake type (Normally closed, i.e. 0 V supply – brake is blocked, 24 V supply – brake unblocked). On output is set low polarity (LOW), because low level cause its locking. In case of reverse operation of brake please set its polarity on high (HIGH).



IX Last configuration stage is configuration of braking resistor. Please execute it according to description at 5.7 chapter. In case of drives with low inertia/power build-in, internal resistor of SID116 is enough. At driver is build-in 10 Ω resistor with power 10 W.

10. Rezystor Hamujący	
Rezystancja Rezystora	10
Moc znamionowa rezystora	10

X After setting all parameters above please execute record of all settings (1).



XI Driver is preprogrammed for configuration. Next stage is to start motor to check if connections are correct. To do this please connect motor according to description at **Błąd! Nie można odnaleźć źródła odwołania.** chapter.

XII After motor connection please activate ENABLE input. It is recommended to use external switch to give signal on input. Alternatively high state can be also enforced using USB application by pressing on input button connected to ENABLE signal (**Błąd! Nie można odnaleźć źródła odwołania.** chapter).

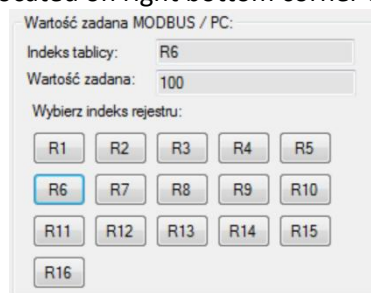


XIII When drive is equipped with brake, correctly configured driver should release the lock after giving ENABLE signal, in other case please change brake polarity or check connecting cables.

XIV The next stage is to enforce motor motion. To do this please increase PWM signal duty by 10% until achieving motion at motor axis. Please select R6 setting. Its default value is 100 and „PWM_WZGLEDNIE” type, which means that each reselection of setting will increase current setting by 100 which gives 10% of its duty.

Rejestr	Wartość	Typ
R1	0	PWM_BEZWZGLEDNIE
R2	1	PWM_WZGLEDNIE
R3	-1	PWM_WZGLEDNIE
R4	10	PWM_WZGLEDNIE
R5	-10	PWM_WZGLEDNIE
R6	100	PWM_WZGLEDNIE

Setting can be activated from panel located on right bottom corner of application window.



XV Each pressing of R6 button should increase PWM (1) signal value by 100. Mentioned above activity should be repeated until motor will start to rotate. Please pay attention to current driver current consumption (2).

Status:	
Stan Sterownika: REGULACJA	
Tryb Kontrolera: OTWARTA PĘTLA (PWM)	
Tryb Profilu Rampy: NIEAKTYWNY	
Pozycja [steps]: 0 (4) 436 200	
Prędkość Obr. [rpm]: (3) 155,00	Prąd [mA]: (2) 904
Temperatura [C]: 62	Napięcie zas. [mV]: 23 864
PWM [0.1%]: (1) 100	
Uchyb Pozycji [steps]:	-1
Uchyb Prędkości [rpm]:	-1
Uchyb Prądu [mA]:	0

Correctly connected motor should start to rotate without load already at 10..20% duty.

Depend on motor type please check following factors:

- ONLY MOTOR – please check if rotation direction is correct – in other way please exchange order of motor wires in connector,
- MOTOR + ENCODER – please check if sign at PWM signal (1), Current measurement (2), Velocity (3), Position (4) is compatible, i.e. **all values should be positive or negative**. In case of sign incompatibility please exchange order of motor cables (change of rotation direction) or exchange A and B encoder signals (change of counting direction),
- MOTOR + BRAKE – in case of drive equipped with brake please follow rules for options above. If drive won't execute motion please observe motor current (2), high current might mean drive locking caused by active brake. If brake is blocked please change brake controlling output polarity.

XVI If while configuration occurred errors or drive operates incorrectly e.g. it heats, go to 5.8 chapter. If motor operates correctly it can be used in Open Loop mode.

For activation of regulation modes it is necessary regulator adjusting 5.3.

5.2 Open loop operation (PWM mode)

Driver basic operation mode is an open loop mode. At this mode setting value is transmitted directly as Pulse Width Modulation signal duty value which control motor. Setting value is calculated in relation 1/10. It means that setting value equal to 1 corresponds to 0.1% PWM signal duty. Setting sign determines motor rotation direction, regulation range is from -96% up to 96% input voltage. Exemplary setting values:



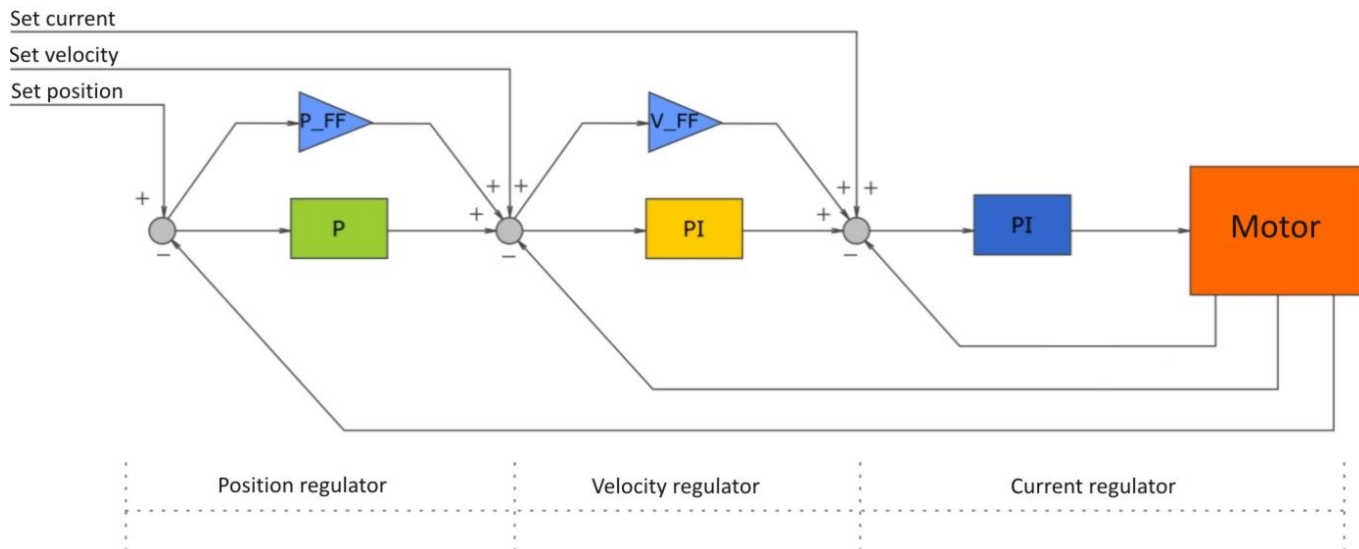
Maximal PWM signal duty can be lower when motor voltage limit is active.

Setting value R1..R16	Setting type	PWM duty	Description
-960	PWM_BEZWZGLEDNIE	-96%	Motor is control with maximal duty to negative rotation direction
-500	PWM_BEZWZGLEDNIE	-50%	Motor is control with 50% duty to negative rotation direction
-100	PWM_BEZWZGLEDNIE	-10%	Motor is control with 10% duty to negative rotation direction
0	PWM_BEZWZGLEDNIE	0	Motor is stopped
100	PWM_BEZWZGLEDNIE	10%	Motor is control with 10% duty to positive rotation direction
500	PWM_BEZWZGLEDNIE	50%	Motor is control with 50% duty to positive rotation direction
960	PWM_BEZWZGLEDNIE	96%	Motor is control with maximal duty to positive rotation direction
-100	PWM_WZGLEDNIE	Decreasing by 10%	Decreasing current duty by 10%
0	PWM_WZGLEDNIE	No changes	Drive after taking command will be move with previously set duty. This function is useful while control using inputs setting (R1-R10) or Jog command
100	PWM_WZGLEDNIE	Increasing by 10%	Increasing of current duty by 10%

Furthermore at open loop mode current limit is active. If motor current will exceed rated current set at application settings driver will limit it to safe value. Drive can signalize overloads which is defined at error handling window.

5.3 Regulator adjusting.

5.3.1 Regulator structure.



Picture. 22. Regulator structure

At SID116 driver is implemented sequence position regulator. This type of regulator consist of three regulation loops responsible for separate physical quantity. Regulators are connected to each other creating a sequence. This means that input of slave regulator is controlled by output of master regulator. SID116 driver regulator consist of current, velocity and position regulator. Position regulator input is set position. Position regulator output is connected to velocity regulator. Velocity regulator controls current regulator input. Due to regulator topology, adjustment should be started from current regulator. While drive is equipped with encoder first of all velocity regulator should be adjusted, then position regulator.



CAUTION!

While using current/velocity/position regulation modes driver requires adjustment of regulator parameters for correct operation.

5.3.2 Driver exemplary configuration.

Parameters as below are presented for following set:

Table 5. Set, for which are presented parameters

Motor	Buehler 1.13.044.413 Rated current: 7 A Rated voltage: 12 V Rated velocity: 3000 rpm
Encoder	MHK40, 3000 pulses per revolution
Gear	None
Brake	None
Load	Constant, inertia 250 g/cm ²

03. Parametry Silnika

Rozdzielczość enkodera	3000
Prąd znamionowy silnika	7000
Prędkość znamionowa silnika	3000
Napięcie znamionowe silnika	12000
Napięcie źródła zasilania	12100

02. Parametry Regulatora

Regulator pozycji : Wzmocnienie P	0,1
Regulator pozycji : Współczynnik Fee	0,1
Regulator prędkości : Wzmocnienie P	1
Regulator prędkości : Wzmocnienie I	1
Regulator prędkości : Współczynnik F	5
Regulator prądu : Wzmocnienie P	0,005
Regulator prądu : Wzmocnienie I	0,09

Picture. 23. Motor and encoder parameter configuration

Picture. 24. Regulator settings

5.4 Current regulation

Current regulation mode allows to control using motor set current. To activate this mode please select Current/Torque Regulation tab and press „Activate mode” button (1). All values at this mode are in mA (e.g. 1000 = 1000 mA = 1A). Then please select proper control interface at main application window in control interface selection tab **Błąd! Nie można odnaleźć źródła odwołania..**

Register settings can be edit using form indicators (2-6). Index of selected setting (2) can be select using drop-down list or directly by pressing on selected setting in a table (10). Setting value (3) is an integer number with a sign. After entering a setting, pressing ENTER button will cause record to driver memory. Setting type (4) defines functions to be used with a setting:

- PRAD_BEZWZGLEDNIE – setting value will be set directly as a set value in mA,
- PRAD_WZGLEDNIE – setting value will be summed with current value set in mA.

Read (5) and record (6) buttons are used for collecting and transferring setting table to the driver.

Rejestr	Wartość	Typ
R1	0	PRAD_BEZWZGLEDNIE
R2	1 (10)	PRAD_WZGLEDNIE
R3	-1	PRAD_WZGLEDNIE
R4	10	PRAD_WZGLEDNIE
R5	-10	PRAD_WZGLEDNIE
R6	100	PRAD_WZGLEDNIE
R7	-100	PRAD_WZGLEDNIE
R8	1000	PRAD_WZGLEDNIE
R9	10	PRAD_BEZWZGLEDNIE
R10	-10	PRAD_BEZWZGLEDNIE
R11	100	PRAD_BEZWZGLEDNIE
R12	-100	PRAD_BEZWZGLEDNIE
R13	1000	PRAD_BEZWZGLEDNIE
R14	-1000	PRAD_BEZWZGLEDNIE
R15	10000	PRAD_BEZWZGLEDNIE
R16	0	PRAD_BEZWZGLEDNIE

Picture. 25. Current/Torque regulation tab

Velocity limit function allows to limit maximal speed of a drive equipped with encoder. To activate velocity limit please configure encoder at advanced setting sheet. Please select „ON” option (8) and enter velocity limit as positive integer value (9) then confirm with ENTER button.

If drive isn't equipped with encoder, motor velocity can be limited using voltage. To do this please select „OFF” option (7). At advanced settings tab please enter rated voltage lower than current voltage. It will cause limiting of voltage transmitted to a motor.



After configuration settings should be saved using button placed at main application window. In other case voltage decline will restore previous driver settings.

5.5 Velocity regulation

Velocity regulation mode allows to control driver set velocity. To activate this mode please select Velocity regulator tab and press „Activate mode” button (1). All values at this mode are in rpm (profile on (7)) or in steps/s (profile on (8)). Then please select proper control interface at main application window at control interface selection tab **Błąd! Nie można odnaleźć źródła odwołania.**

Register settings can be edit using form indicators (2-6). Index of selected setting (2) can be selected using drop-down list or directly by pressing on selected setting in table (10). Setting value (3) is an integer value with a sign. After entering a setting pressing ENTER button will cause record to driver memory. Setting type (4) defines functions to be used with a setting:

- PREDKOSC_BEZWZGLEDNIE – setting value will be set directly as a set value,
- PREDKOSC_WZGLEDNIE – setting value will be summed with current set value

Read (5) and record (6) buttons are used for collecting and transferring setting table to the driver.

Otwarta Pętla | Regulacja Prądu/Momentu | Regulacja Prędkości | Regulacja Pozycji | Regulacja Mieszana

Regulator Prędkości
Kaskadowy regulator prędkości z możliwością ustawienia profilu prędkości.

Dostępne typy nastaw:
PREDKOSC_BEZWZGLEDNIE - ustawia nastawę jako wartość zadaną [rpm] z profilem [steps/s]
PREDKOSC_WZGLEDNIE - zwiększa/zmniejsza wartość zadaną o nastawę[rpm] z profilem [steps/s] (1)

Opcje:
Profil Prędkości - umożliwia ograniczenie prędkości maksymalnej i przyspieszenia napędu

Tablica Nastaw

Rejestr	Wartość	Typ
R1	0	PREDKOSC_BEZWZGLEDNIE
R2	1 (11)	PREDKOSC_WZGLEDNIE
R3	-1	PREDKOSC_WZGLEDNIE
R4	10	PREDKOSC_WZGLEDNIE
R5	-10	PREDKOSC_WZGLEDNIE
R6	100	PREDKOSC_WZGLEDNIE
R7	-100	PREDKOSC_WZGLEDNIE
R8	1000	PREDKOSC_WZGLEDNIE
R9	10	PREDKOSC_BEZWZGLEDNIE
R10	-10	PREDKOSC_BEZWZGLEDNIE
R11	100	PREDKOSC_BEZWZGLEDNIE
R12	-100	PREDKOSC_BEZWZGLEDNIE
R13	1000	PREDKOSC_BEZWZGLEDNIE
R14	-1000	PREDKOSC_BEZWZGLEDNIE
R15	10000	PREDKOSC_BEZWZGLEDNIE
R16	0	PREDKOSC_BEZWZGLEDNIE

Index Tablicy Nastaw: (2)

Wartość Nastawy: (3)

Typ Nastawy: (4)

Odczytaj/Zapisz:
 (5) (6)

Profil Prędkości
 Wyłączony (7) Włączony (8)

Limit Prędkości: 100 [Obr/s] (9)
Limit Przyspieszenia: 10 [Obr/s²] (10)

Picture. 26. Velocity regulation tab

Velocity profile allows to define maximal velocity and acceleration values for velocity changes. To activate this mode please select „ON” option (8) and enter profile parameters: maximal velocity (9) and acceleration (10).

5.6 Position regulator

Position regulation mode allows to control driver set position. To activate this mode please select Position Regulator and press „Activate mode” button (1). All values at this mode are in steps which correspond to encoder

pulses with consider of signal square wave. Then please select proper control interface at main application window in control interface selection tab **Błąd! Nie można odnaleźć źródła odwołania..**

Regulator Pozycji
Kaskadowy regulator pozycji z możliwością ustawienia profilu prędkości.

Dostępne typy nastaw:
POZYCJA_BEZWZGLEDNIE - ustawia nastawę jako wartość zadaną [steps]
POZYCJA_WZGLEDNIE - zwiększa/zmniejsza wartość zadaną o nastawę [steps]

Opcje:
Profil Prędkości - umożliwia określenie przyspieszenia i maksymalnej prędkości z jaką zostanie wykonany ruch

Tablica Nastaw

Rejestr	Wartość	Typ
R1	0 (11)	POZYCJA_BEZWZGLEDNIE
R2	1	POZYCJA_WZGLEDNIE
R3	-1	POZYCJA_WZGLEDNIE
R4	10	POZYCJA_WZGLEDNIE
R5	-10	POZYCJA_WZGLEDNIE
R6	100	POZYCJA_WZGLEDNIE
R7	-100	POZYCJA_WZGLEDNIE
R8	1000	POZYCJA_WZGLEDNIE
R9	10	POZYCJA_BEZWZGLEDNIE
R10	-10	POZYCJA_BEZWZGLEDNIE
R11	100	POZYCJA_BEZWZGLEDNIE
R12	-100	POZYCJA_BEZWZGLEDNIE
R13	1000	POZYCJA_BEZWZGLEDNIE
R14	-1000	POZYCJA_BEZWZGLEDNIE
R15	12000	POZYCJA_WZGLEDNIE
R16	0	POZYCJA_BEZWZGLEDNIE

Index Tablicy Nastaw: (2)

Wartość Nastawy: (3)

Typ Nastawy: (4)

Odczytaj/Zapisz:

Odczytaj (5) Zapisz (6)

Profil Prędkości

Wyłączony (7) Włączony (8)

Limit Prędkości: 100 [Obr/s] (9)

Limit Przyspieszenia: 10 [Obr/s²] (10)

Picture. 27. Position regulator tab

Register settings can be edit using form indicators (2-6). Index of selected setting (2) can be selected using drop-down list or directly by pressing on selected setting in table (10). Setting value (3) is an integer value with a sign. After entering a setting pressing ENTER button will cause record to driver memory. Setting type (4) defines functions to be used with a setting:

- POSITION_BEZWZGLEDNIE – setting value will be set directly as a set value in steps,
 - POSITION_WZGLEDNIE – setting value will be summed with current set value in steps
- Read (5) and record (6) buttons are used for collecting and transferring setting table to the driver.

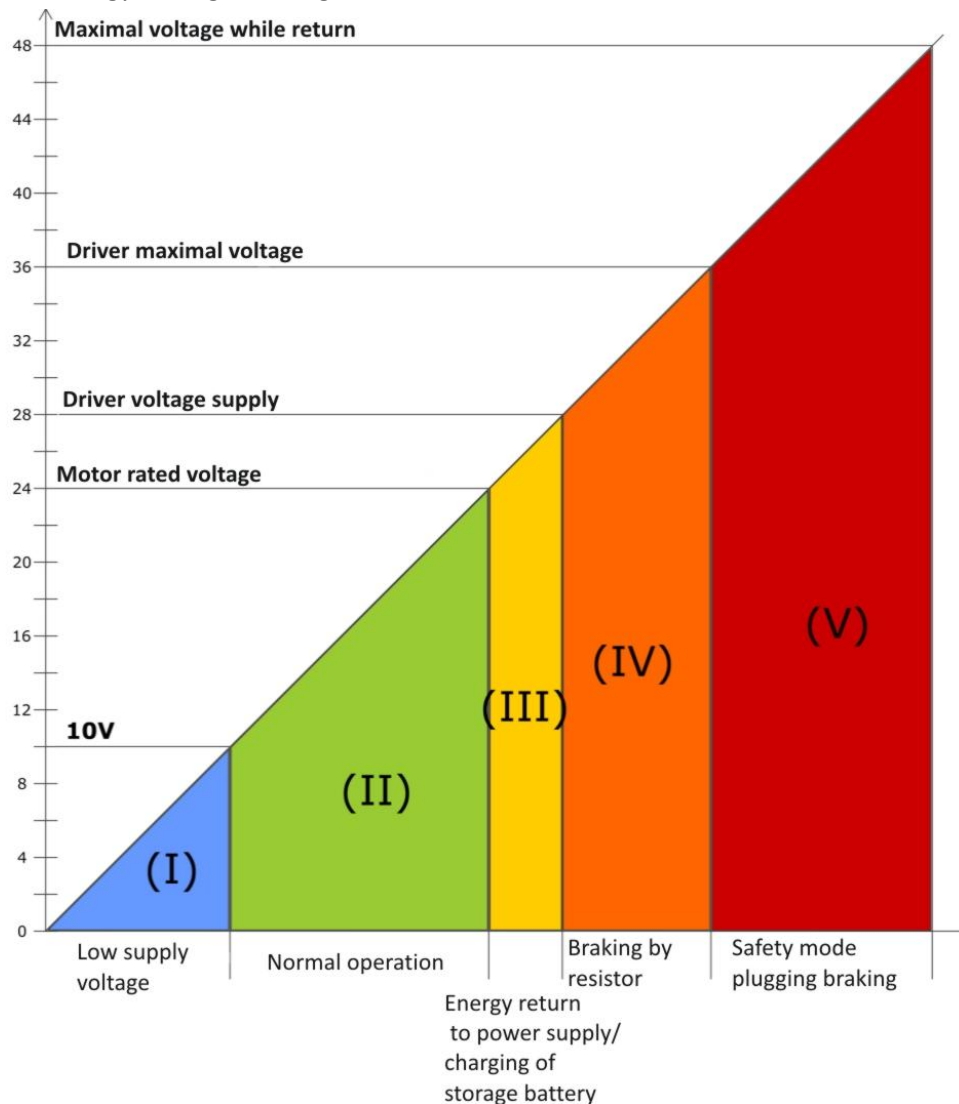
Velocity profile allows to define maximal velocity and acceleration values for velocity changes. To activate this mode please select „ON” option (8) and enter profile parameters: maximal velocity (9) and acceleration (10).

5.7 Dynamic braking (braking resistor)

5.7.1 Dynamic braking function.

SID116 is a 4Q driver. It allows motor control as well as normal operation as at generator mode. At normal mode motor charge energy from power supply and exchange into mechanical energy driving mechanical system. At generator mode motor is drive by mechanical system e.g. as a result of inertia or gravity mechanical energy transmitted to motor shaft is convert into electric energy, which returns to power supply source through the driver. The advantage of this solution is possibility of using returned energy for charging e.g. storage batteries when motor operates at mobile application.

In case of electric motors energy returns in form of high power short pulses. Excess of energy from motor is converted into thermal energy through braking resistor.



Picture. 28. Driver operation modes

Depend on driver voltage supply can be distinguished following driver operation modes:

- I** Safe mode. Below 10 V driver voltage supply is too low and normal operation is not possible. SID116 turns into safe mode (error: voltage supply <10 V).
- II** Normal operation state. Driver transmits energy to motor.
- III** Normal operation state. Driver is in return energy to power source mode.
- IV** Normal operation state. Driver lose energy on braking resistor.
- V** Safe mode. Voltage on motor is above safe level for driver. Driver turns into safe mode (error: Voltage supply >36 V). Motor plugging braking.

User can configure II and III sector by setting motor voltage supply and supply voltage at driver settings. Other sectors are a result of driver construction.

5.7.2 Braking resistor. Parameters selection.

Driver has build-in cement resistor with resistance 10 Ω and rated power 10 W. SID116-PC software provides configuration of power and resistance of braking resistor.

10.Rezystor Hamujacy	
Rezystancja Rezystora	10
Moc znamionowa rezystora	10

Picture. 29. Braking resistor

Default parameters are consonant with settings of internal resistor. Driver based on this parameters and measured voltage determines maximal braking power. While resistor configuration please pay attention to settings of motor rated voltage and driver voltage supply. Set motor rated voltage can't be higher than driver set voltage supply. Set driver voltage supply must be lower than maximal existing voltage of supply source. In other case driver will lose excessive voltage in resistor.

Example: Supply driver from storage battery with 24 V rated voltage, charging voltage of such accumulator is usually higher and can have about 28 V. Voltage of charged storage battery will be higher than 24 V. So if we will set 24 V driver voltage supply, driver after exceeding 24 V will activate braking resistor which will try to decrease voltage to 24 V level, irrespective of the fact drive is active or not which means that storage battery will be discharged to 24 V level. That's why driver voltage supply at settings should be set to maximal value, which at this example is 28 V. The same concerns power supply units, which have voltage pulsation on output. Then please measure real voltage supply or give it with 10 % reserve.

Resistor rated power at application is a constant power at while resistor can safely operate for 30 min. When resistor is build-in there is an option to overload it 10 times, under condition that overloading time do not exceed 5 seconds and average power at cyclic overloading will not exceed rated 10 W. It means that in application can be entered max 100 W value for internal resistor, under condition that drive braking will take no longer than 5 seconds and braking time won't exceed 10 % of driver operation cycle.

When resistor power is too low driver will turn into safety mode (error: voltage supply >36 V) due to voltage induced by braking/returning motor. It is necessary to use external braking resistor. Resistor connection is presented at **Błąd! Nie można odnaleźć źródła odwołania.** chapter. External braking resistor is connected parallel with external resistor and controlled from the same transistor. It means that while braking both resistors will conduct current according to Ohm law. Power stored on individual resistor will depend on its resistance, so resistance of external resistor should be lower than internal resistor.

5.8 Driver error handling.

5.8.1 Errors description

Table 6. SID116 driver allows the user access to following error signals

Signal	Description	Type
Voltage supply <10 V	Voltage supply below minimal voltage	Critical
Voltage supply >36 V	Voltage supply above maximal level	
System overheating >105°C	Exceeding of allowable operating temperature	
Drive overload	Current limit active longer than 5 s	Configurable
Velocity tracking error	Exceeding allowable velocity error, limit configuration allowable at advanced settings – error handling	
Profile tracking error	Exceeding allowable profile error is available at advanced settings – error handling	
Profile value error	Wrong profile input data	

5.8.2 Handling in case of errors

Table 7. Handling in case of errors

Errors / Symptoms	Possible cause	Solution
Voltage supply <10 V	PSU damage or discharging of supply battery storage	Check driver power supply. Please make a measurement while loading
	Low power efficiency of PSU/ storage battery	Decrease rated current at drive settings
Voltage supply >36 V	Damage of PSU	Check driver voltage supply
	If error occur while drive operation, especially while changing of motor velocity, it can mean too high returning energy from drive, exceeding resistor power	Please check settings of braking resistor 5.7
		Please use resistor with higher power 5.7
System overheating >105°C	If error occur while constant load of a drive, while current consumption >50% rated	Please use additional radiator on driver or enforce air circulation around driver housing
		Please limit motor rated current at settings
	If drive overheat while normal operation at low load <50% rated	Please check braking resistor configuration, possible setting too high power at internal resistor
		While using external resistor, if resistor doesn't heat up, please check connection with external resistor.
Drive overload	Drive is locked, load is too high. Motor operate with limit current	If +5V output is used please check if output current consumption do not exceed 150 mA. Current exceeding can cause overheating of build-in voltage stabilizer.
		Please check motor mechanical load. Please increase rated current in allowable range.
Velocity tracking error	It occurs while velocity or position regulation mode without profile when drive can't hold set velocity	If drive react with too low dynamic and current is not limited, please adjust driver regulator
		If while moving current was limited, it is possible that drive load is too high and should be entered higher offset at 5.8
Profile tracking error	It occurs at position and velocity regulation mode with profile when drive can't hold set profile	If drive react with too low dynamic and current is not limited, please adjust driver regulator
		If while moving current was limited, it is possible that drive load is too high, please set higher offset at 5.8 or decrease maximal velocity or profile acceleration
Profile value error	It occurs when position/velocity isn't possible to achieve at current drive state/position at	Please change velocity profile parameters for used mode

	defined profile parameters	
Drive speed up to maximal velocity in opposite direction to set setting	Damage of encoder or incorrect cable connection	Please check encoder operation. Please check if counting pulses direction from encoder is the same as motor polarity
Drive screech while operation with regulator	Overregulation of current regulator	Please decrease current regulator settings
Drive starts vibrate or oscillate while operation	Overregulation of position or velocity regulator	Please check and if necessary decrease position or velocity regulator settings

6. MODBUS communication

Driver allows communication with master device (MASTER) at MODBUS-RTU protocol. Communication is made via RS485 port.

Transmission parameters

- Default address: 1 (configurable in range 1..126)
- Default address: **38400 b/s** (available speeds 9600, 19200, 38400, 57600, 115200)
- Stop bit: **1**, Parity: **none**
- Timeout: **750µs** (max interval between next bytes in frame)

Communication description, list of user registers and way of drive control by MODBUS-RTU is available at „*SID116_protokol_MODBUS.pdf*” documentation.

7. Record of changes

Table 8. Record of changes

Version	Firmware	PC program
1.00	- first version	- first version

8. Technical parameters

Table 9. Technical parameters

Description	Parameter
Power supply	Voltage : 12 ... 30 VDC
Current consumption (rest)	At supply 12 V : 130 mA At supply 24 V : 80 mA
Motor	Max. voltage.: 30 V Max. direct current: 16 A Switching frequency: 18 kHz
Encoder	Type: Incremental Voltage: 5-24 V Max. frequency: 1 MHz
Mechanical brake	Voltage: 10 – 24 V (depend on VDDQ) Max. current: 2 A
Internal braking resistor	Resistance : 10 Ω Power : 10 W / 30 min Possible overload : 10x Max. power : 100W / 5 s
External braking resistor (optionally)	Resistance 0.47 – 10 Ω Max current. 50 A Max power. 1000 W
Inputs IN0.1 .. IN0.8	Opt insulation: yes Low state: below 2 V High state: +5...+24 V
Inputs IN1.0 .. IN1.2	Opt insulation: none Low level: below 2 V High state: +5...+24 V
Outputs Q0 .. Q1	Opt insulation: yes Type : transistor P-MOS Constant current: max. 2 A
Supply of outputs	Voltage on VDDQ and GNDQ terminals : 10 – 24 V
Output +5V	Max current : 150 mA Build-in voltage stabilizer: YES
Analog input AIN	Voltage: 0 ... 10 V Measurement resolution: 0.006 V
Position regulation	Regulation period : 8 ms (125 Hz)
Velocity regulation	Regulation period: 1 ms (1 kHz)
Current regulation	Regulation period: 0.125 ms (8 kHz)
Communication	RS485 : Communication protocol: MODBUS - RTU SLAVE USB: 1.1, 2.0 (HID) : Parameters configuration
Operation temperature range	5..50°C
Weight	280 g (without radiator)
Housing	139x80x30 mm (without radiator), mounting on DIN rail
Degree of protection	IP20