

## SMARTDRIVE-S3

**SMARTDRIVE-S3** belongs to the bipolar stepper motor position controllers family. It is a complete ready-to-run unit, comprising a programmable positioning controller, the PWM power output stage, and all the necessary control interfaces. Predefined motion control sequences can be executed autonomously. Additional profiles can be specified via the serial bus whenever required. The output stage features two high performance sinusoidal current control loops. External interfaces comprises opto-isolated control I/Os, limit switch inputs, analog inputs, an incremental encoder interface and a serial communication port.

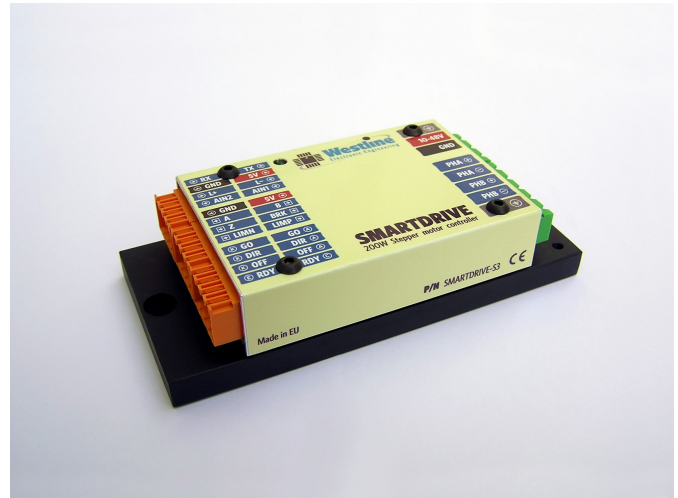
All parameters and controller firmware are accessible over the serial interface using a Windows-based software.

### Advantages

- Integrated speed and positioning controller
- Integrated power driver with thermal and short-circuit protection
- Operation in micro-step mode
- Programmable idle, running and acceleration currents
- Programmable acceleration and speed limits
- Limit and home switches handling
- Autonomous operation or externally driven
- Accepts industry-standard step-and-direction control mode
- Small size and quiet operation

### Applications

- Special machinery
- Simple positioning systems
- Pneumatic actuator replacement



### Technical Specifications

Power supply .....	10 ÷ 48 V <sub>DC</sub> <sup>†</sup>
Phase current .....	0 ÷ 3 A <sub>RMS</sub>
Analog inputs/outputs .....	0 ÷ 5 V
Digital inputs/outputs .....	TTL
Encoder inputs .....	TTL
Isolated digital inputs .....	0 ÷ 24 V
Isolated digital outputs .....	0 ÷ 24 V / 100 mA max.
µStep resolution .....	1 ÷ 2048 µstep / full step
Position range .....	-2 <sup>31</sup> ÷ 2 <sup>31</sup> - 1 µstep
Speed range .....	0 ÷ 3000 rpm
Acceleration range .....	0 ÷ 30000 rpm/s
External clock frequency on A/B inputs .....	0 ÷ 12 MHz
External clock frequency on GO/DIR inputs .....	0 ÷ 200 kHz
Serial interface .....	RS232 <sup>‡</sup> and RS485
Weight .....	175 g

<sup>†</sup> 5V on request

<sup>‡</sup> 2 m maximum distance

### Order Code

SMARTDRIVE-S3

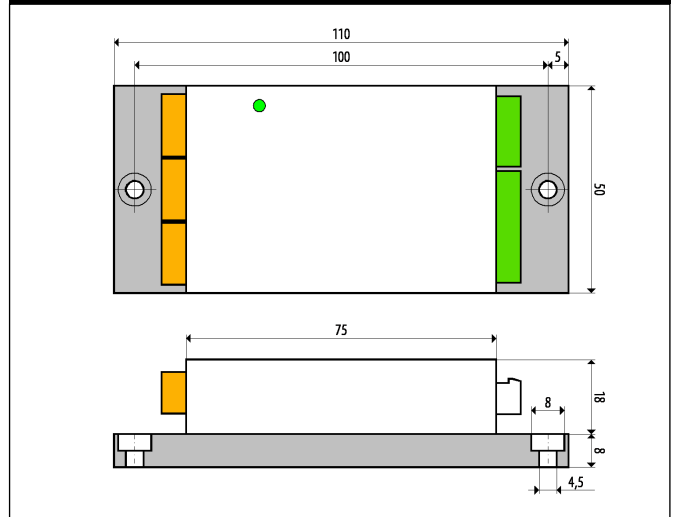
### External Connections

RXD (RS232)	• RX • TX •	TXD (RS232)	• SHLD • shield
ground	• GND • +5V •	5V output / 100 mA	• +VS • power supply
L+ (RS485)	• L+ • L- •	L- (RS485)	• GND • ground
analog input	• AIN2 • AIN1 •	analog input (speed)	
ground	• GND • +5V •	5V output / 100 mA	• PHA+ • A+ motor phase
phase A encoder input	• A • B •	phase B encoder input	• PHA- • A- motor phase
index encoder input	• Z • BRK •	digital output	• PHB+ • B+ motor phase
negative limit switch input	• LIMN • LIMP •	positive limit switch input	• PHB- • B- motor phase
			• SHLD • shield
GO input cathode	• GO <sub>k</sub> • GO <sub>A</sub> •	GO input anode	
DIR input cathode	• DIR <sub>k</sub> • DIR <sub>A</sub> •	DIR input anode	
OFF input cathode	• OFF <sub>k</sub> • OFF <sub>A</sub> •	OFF input anode	
RDY output emitter	• RDY <sub>e</sub> • RDY <sub>c</sub> •	RDY output collector	

#### Recommended connectors

- Weidmüller BZL 3.5/8, 8 way socket block, RS 382-9602
- Phoenix Contact COMBICON MSTB 2.5/3-ST-5.08, 3 way straight plug, RS 189-6026
- Phoenix Contact COMBICON MSTB 2.5/5-ST-5.08, 5 way straight plug, RS 189-6048

### Dimensions (mm)

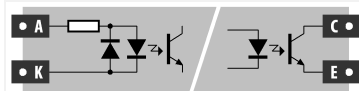


**User's Guide**

**External connections**

**Opto-isolated I/Os**

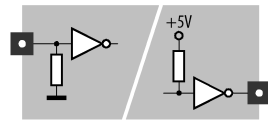
The A/K connections will drive the opto-isolator diode through the polarization circuit. The operating voltage on A input (related to K) is +5V to +24V without the need of an external limiting resistor. The C/E are the collector/emitter NPN transistor outputs of the opto-isolator.



**OFF** – when activated the power output of the controller is disabled, the trajectory generator and the GO/DIR inputs are off. Toggling the OFF input will clear the current alarms and the current selected operating mode is reloaded. OFF input can be left unconnected if unused.

**GO** and **DIR** operation is related to the actual operating mode. The operation is front or level sensitive depending the current operating mode.

**RDY** is activated when the controller is ready to operate. During the execution of an order RDY is deactivated and will be activated again when the displacement is finished.



**Digital I/Os**

The digital I/Os are TTL compatible with internal pull-downs on the inputs.

When activated **LIMN** will stop the movement in the negative direction. The current trajectory is discarded and the motor stops. The positive direction is not affected. LIMN can also be used as an origin input.

When activated **LIMP** will stop the movement in the positive direction. The current trajectory is discarded and the motor stops. The negative direction is not affected.

**!** On devices with serial numbers prior to **SD0201** the LIMN and LIMP inputs had internal pull-ups. See the previous revisions of this datasheet for those devices.

**BRK** is a logical output reserved for special applications (driving a brake circuit for example). The internal preloaded modes don't make use of that output.

**A**, **B** and **Z** are inputs to the position feedback decoder. Special application software is needed to make use of these inputs. Typically A and B are quadrature inputs and Z is the zero index from an incremental encoder. Alternate function for A and B is pulse and sense inputs when this operating mode is selected.

**Analog I/Os**

**AIN1** and **AIN2** are two analog inputs provided for special applications. AIN1 is used as an external speed limit by the majority of the pre-programmed modes. When connected to a potentiometer the maximum speed can be adjusted. When the AIN1 is left unconnected an internal pull-up will apply maximum speed as specified by software.

**RS232 communication lines**

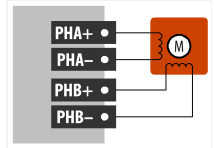
**RX** is a reception input and must be connected to TxD of the RS232 serial port. **TX** is a transmit output and must be connected to RxD of the RS232 serial port. An opto-isolated USB to RS232 adapter is available (P/N: *ISOBUS-232*).

**RS485 communication lines**

**L+** and **L-** lines are used as a transmit/receive differential pair and must be connected to L+/L- of the RS485 bus adapter. An opto-isolated USB to RS485 adapter is available (P/N: *ISOBUS-485*).

**Motor outputs**

The two coils A and B of the stepper motor will be connected to the **PHA+/PHA-** and **PHB+/PHB-** respectively. If you need to change the rotation sense you just have to reverse the connections for one of the coils. The connector provide also one pin for the shield grounding of the motor cable.



**Power Supply**

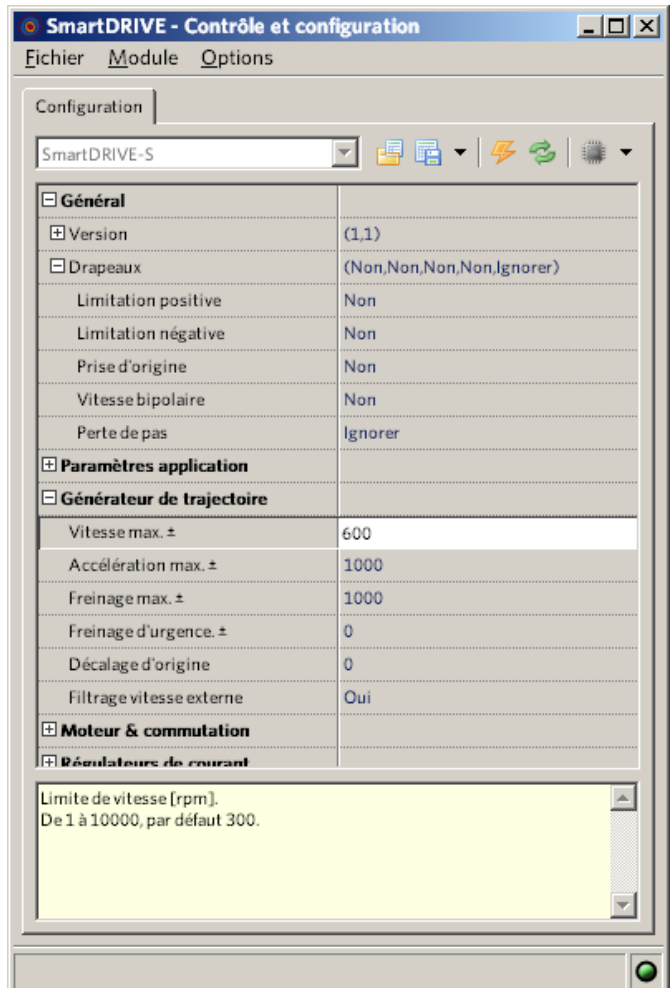
The controller needs a DC unregulated power supply. A dedicated connector is provided for **+VS**, **GND** and the cable shield connection **SHLD**. On signals side one **+5Vdc** output pin is provided to help the speed potentiometer connection or other conditioning circuitry. Another **+5Vdc** output pin is provided for the digital section. When an encoder or limit switch need power you can use that supply.

**!** The only opto-isolated signal pins are GO/DIR/OFF and RDY and they are provided for a PLC connection.

**Configuration**

The controller can be configured on the fly using an easy to use Windows 2000/XP software. First you have to connect the controller to the PC via the RS232 serial port or using an USB adapter. The available parameters are :

- current operation mode
- motor configuration : microstep resolution, current, PID constants
- trajectory parameters
- I/O polarities and limit switches configuration
- alarm trigger levels



**Operating modes (applications)**

The preloaded modes are controlled by the GO/DIR inputs. The RDY output can be used to monitor the status of the controller.

An internal pulse generator can replace the GO input. The on time and the period is user adjustable. This generator is useful for implementing plenty of simple applications without the need of an external PLC. The pulse generator can be used only with the modes making use of the trajectory generator (not in pulse input mode)

The trajectory generator will adjust the amplitude of the motor currents. When motor is stopped the hold current will maintain the rotor on the actual microstep position. During the acceleration and deceleration phases the acceleration current will be used and during the constant speed operation the work current will be used.

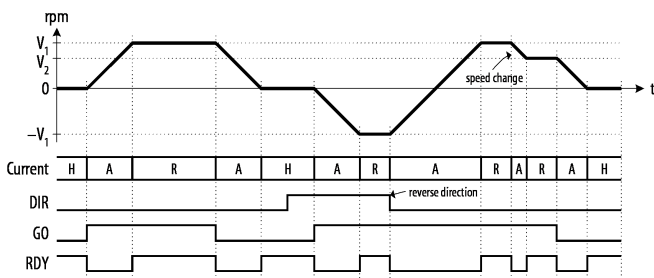
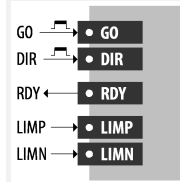
Available modes are:

- speed with level operated GO and DIR inputs
- speed with level operated GOCW and GOCCW inputs
- speed with front operated GO and DIR inputs (start/stop)
- speed with front operated GOCW and GOCCW inputs (start/stop)
- travel with GO and DIR inputs – act like an transport conveyor
- travel with GOCW and GOCCW inputs – act like an transport conveyor
- simple push-pull with GO/DIR inputs – act as an pneumatic jack
- push-pull with GO/DIR inputs and position zeroing on limit switch
- external quadrature clock with GO/DIR inputs
- external clock and direction with GO/DIR inputs
- serial bus operation for multi-axis synchronization

Custom operation modes can be created on request.

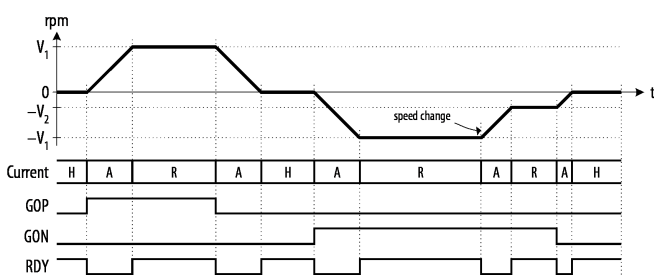
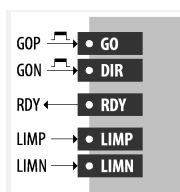
**Speed GO/DIR**

DIR input will select the spinning direction and GO will start the motor. When GO is activated the motor will spin at the specified speed or accelerate/decelerate to reach the specified speed. The motor speed will ramp linearly to the target speed.



**Speed GOP/GON**

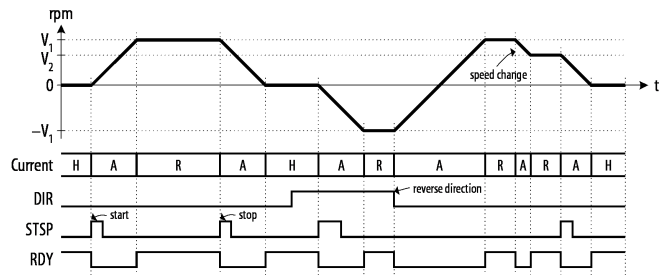
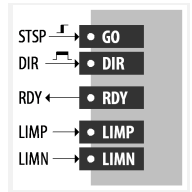
GOP input (GO) will spin the motor in positive direction and GON (DIR) will spin the motor in negative direction. The motor will operate at the specified speed or accelerate/decelerate to reach the specified speed. The motor



speed will ramp linearly to the target speed. The GOP input has priority over GON input.

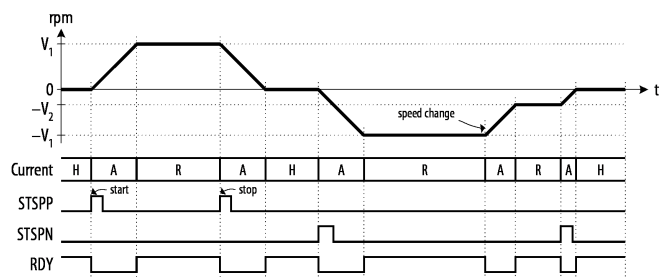
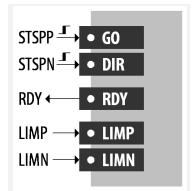
**Speed STSP/DIR**

When the motor is stopped the selected front on STSP input (GO) will start the operation taking DIR input into account. When the motor is spinning the selected front on the same input will stop-it. Changing the polarity of the input will change the active front.



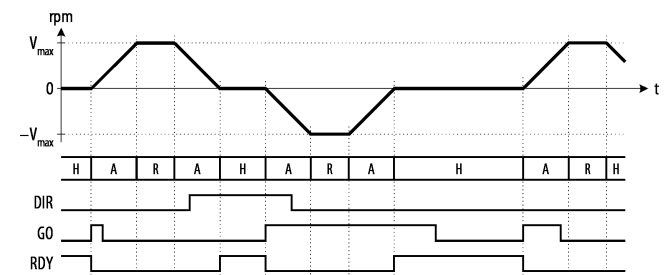
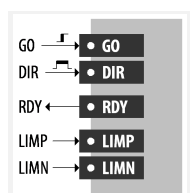
**Speed STSPP/STSPN**

When the motor is stopped the selected front on STSPP input (GO) will start the motor in positive direction and STSPN input (DIR) will start the motor in negative direction. If it is operating the selected front on any of the two inputs will stop the motor. The STSPP input has the priority over STSPN input. Changing the polarity of the GO input will change the active front.



**Travel GO/DIR**

In this mode the motor is executing constant length movements. The DIR input will select the direction and the active front of the GO input will start the cycle. The movement length in micro steps is preloaded in the controller from the control panel on the PC and the profile is trapezoidal. If the limit switches are activated and one of them is reached the



movement is stopped. Changing the polarity of the GO input will change the active front.

**Travel GOP/GON**

In this mode the motor is executing constant length movements. The GOP and GON inputs will start the cycle

