SMD10
SMD11
SMD15
SMD30

Step Motor Drivers

User Manual

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Contents

1.1 Introduction

Types SMD10, SMD11, SMD15 and SMD30 are a series of step motor drivers which meet almost every requirement for precise control of step motors.
The Drivers can be used for controlling a wide range of step motors, supplying phase currents of up to 12 Amp/phase and voltages in the range 12 to 150V.
The following Driver models are available:
- Basic drivers equipped with inputs for step-pulse and direction signals,
- Drivers with an integral step generator which enables trimmer potentiometers to be used for adjusting the motor start rate, acceleration/deceleration rate, and additionally enable two different top rates to be used in the same motor operation.
- A Driver model built into an EMR suppression cabinet with an integral 230 V power supply.

The Drivers are based on the "Bipolar chopper" principle, which provides approximately 40% greater motor torque over a large range of speeds than commonly used "Unipolar chopper" drivers.
The Drivers are equipped with a total of 7 inputs and 4 outputs, all of which are optically isolated from other Driver circuitry.
Two of the inputs are used for end-of-travel inputs which stop motor operation instantaneously when activated. Two analogue inputs enable the motor current and Top Rate to be controlled using an externally applied voltage. DIP Switches on the front panel of the Drivers are used to set different configurations, enabling inputs to be defined for various purposes depending on the actual application.
For example the function of inputs can be defined so that if one input is activated the motor advances, if another input is activated the motor reverses. Alternatively, one input may be used to start the motor, another to stop the motor.
A third input can be used to select one of the two defined motor Top Rates.

Features:

- Only a single supply voltage required.
- External operating frequency 0-20kHz.
- Internal operating frequency 0-10kHz.
- Bipolar chopper driver (0-12A/phase).
  "A" version 3 Amp.
  "B" version 6 Amp.
  "C" version 12 Amp.
- Facility for controlling motor Top Rate via external voltage (0-5 / 0-10V).
- Facility for controlling motor phase current via external voltage 0-5 V.
- Stop Input which stops motor operation immediately the input is activated.
- Status Output which indicates whether the motor is stopped or running.
- CW (Clockwise) and CCW (Counter Clockwise) end-of-travel inputs.
- All inputs and outputs optically isolated.
- All inputs and outputs handle 5-30VDC.
- Facility for 2 motor speeds during same operation.
- Torque of up to 12 Nm at 300 rev/min.
- Overload protection. Motor output short-circuit protected.
- Eurocard dimensions 160x100x47 [mm].
  With integral power supply 160x112x103 [mm].
  SMD11/30 171x111x138 [mm].
- Mounting either in 19"-rack or via T-groove.
- Connection via DIN socket, or terminals (optional).
- Option: Mains-supply 115 V AC.

1.2 Overview of Driver Models

	Driver: 12-45VDC	Driver: 15-80VDC	Driver: 15-150VDC	230 V AC Supply	Driver 3 Amp./phase	Driver 6 Amp./phase	Driver 12 Amp./phase	Step Generator	Conn.: DIN41612 Ver. D	Conn.: DIN41612 Ver. H	Terminal Conn. (option)	Eurocard	Eurocabinet	Dual Driver
SMD10A1	X				X				X		X	X		
SMD10B1	X					X			X		X	X		
SMD10A2	X				X			X	X		X	X		
SMD10B2	X					X		X	X		X	X		
SMD10A3	X			X	X				X		X		X	
SMD10B3	X			X		X			X		X		X	
SMD10A4	X			X	X			X	X		X		X	
SMD10B4	X			X		X		X	X		X		X	
SMD11B3	X			X		X			X		X		X	X
SMD11B4	X			X		X		X	X		X		X	X
SMD15B1		X				X			X		X	X		
SMD15B2		X				X		X	X		X	X		
SMD15B3		X		X		X			X		X		X	
SMD15B4		X		X		X		X	X		X		X	
SMD30C1			X				X		X	X		X		
SMD30C2			X				X	X	X	X		X		
SMD30C3			X	X			X		X	X			X	
SMD30C4			X	X			X	X	X	X			X	

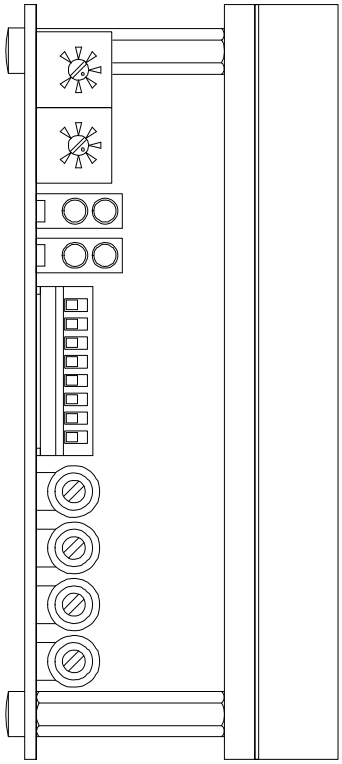
See Section 3.1 for Physical Dimensions

All models include the following features:

- Adjustment of motor Standby Current.
- Adjustment of motor Operating Current.
- End-of-travel, CW/CCW Limit Inputs.
- External adjustment of motor current.
- External switching between Standby Cur-rent and Operating Current.
- LED indication of motor operation.
- Stop Input.
- Status Output for motor operation.
- Error Output.
- Step Pulse Output.
- Direction Output.
- Short-circuit protection of motor output.
- Voltage Output 5V DC/50mA.
- Full- and Half Step modes of operation.
- All digital inputs and outputs optically isolated.
- Automatic switching between Operating and Standby Current.
- Overvoltage protected.

1.3 Front and Rear Panels (SMD10/15_1 / SMD10/15_2 only)

Front Panel :



Adjustment of Motor Operating and Standby Current

Indication of Overload

"Power" Indicator

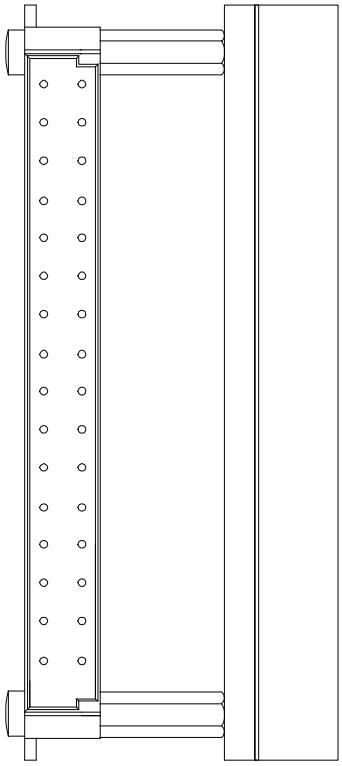
Error Indicator

Motor Operating Indicator

Adjustment of System Parameters

Adjustment of Motor Start Rate, Top Rate and Acceleration
(models with built-in Step Generator only)

Rear Panel :



Connector: DIN41612/Ver. D

Supply 12-45V/15-80V

Status Output

Analogue Input for Control of Motor Current

Analogue Input for Control of Speed

Motor Output

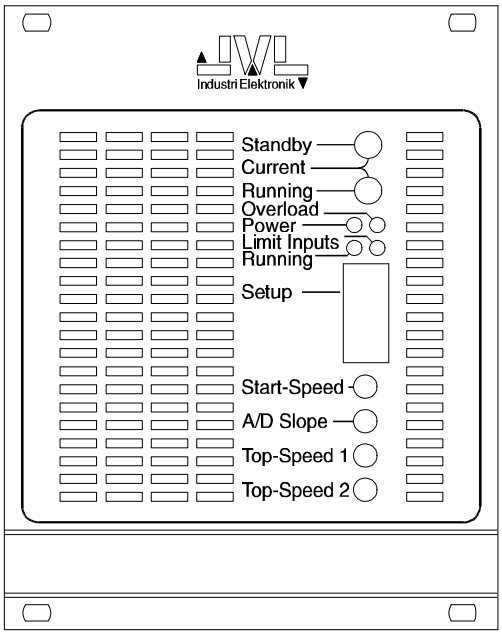
Stop Input

CW/CCW Limit Inputs

Control Inputs

Chassis (ground)

1.3 Front and Rear Panels (SMD10/15_3 / SMD10/15_4 only)

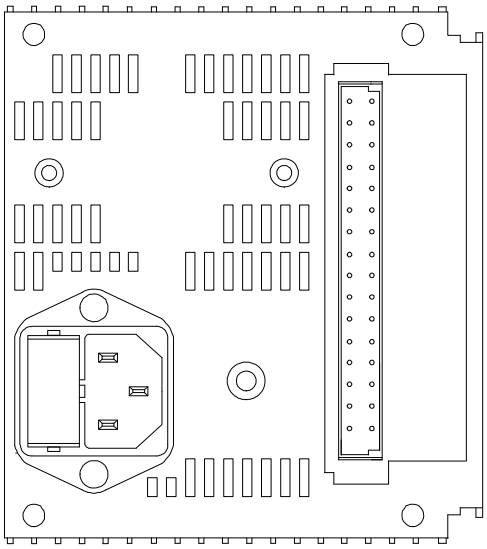


Front Panel :

- Adjustment of Motor Current
- Indication of Overload
  "Power" indicator
  Indication of Error and Motor Operation
- Adjustment of System Parameters
- Adjustment of Motor Start Rate, Top Rate and Acceleration
  (models with built-in Step Generator only)

Rear Panel :

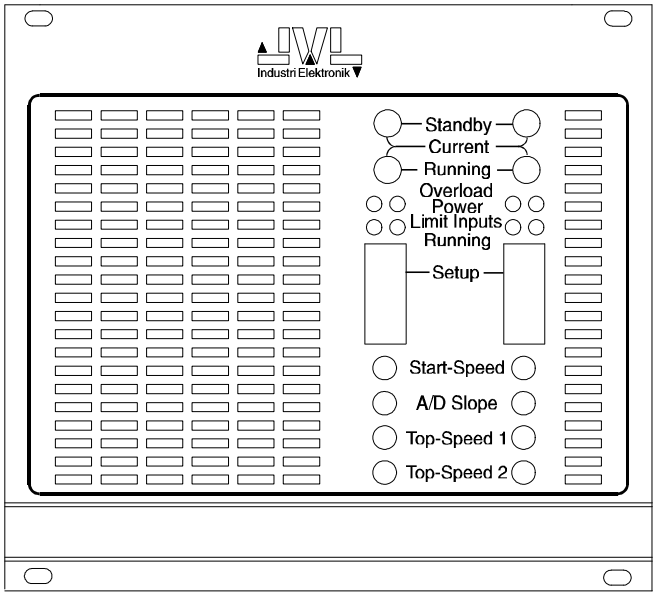
Connector: DIN41612/Ver. D



- Supply 230 V AC
- Status Output
- Analogue Input for Control of Motor Current
- Analogue Input for Control of Speed
  (models with built-in Step Generator)
- Motor Output
- Stop Input
- CW/CCW Limit Inputs
- Control Inputs
- Chassis (ground)

1.3 Front and Rear Panels

(Types SMD11xx only)

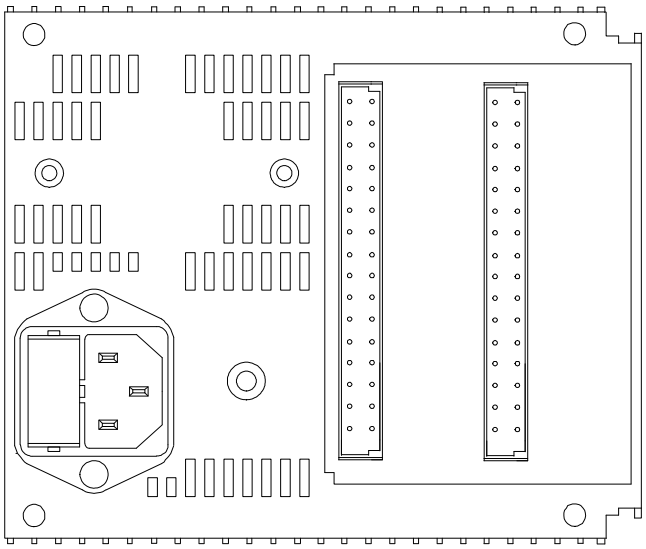


Front Panel :

- Adjustment of Motor Current
- Indication of Overload
  "Power" indicator
  Indication of Error
  Indication of Motor Operation
- Adjustment of System Parameters
- Adjustment of Motor Start Rate,
  Top Rate and Acceleration.
  (models with built-in Step Generator)

Rear Panel:

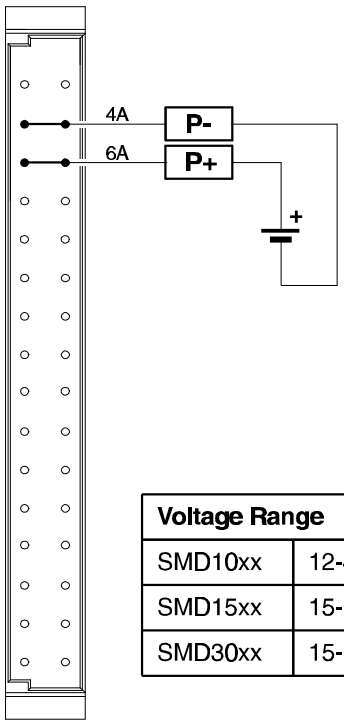
Connector: DIN41612/Ver. D



- Supply 230 V AC
- Status Output
- Analogue Input for Control of
  Motor Current
- Analogue Input for Control of Speed
  (models with built-in Step Generator only)
- Motor Output
- Stop Input
- CW/CCW Limit Inputs
- Control Inputs
- Chassis (ground)

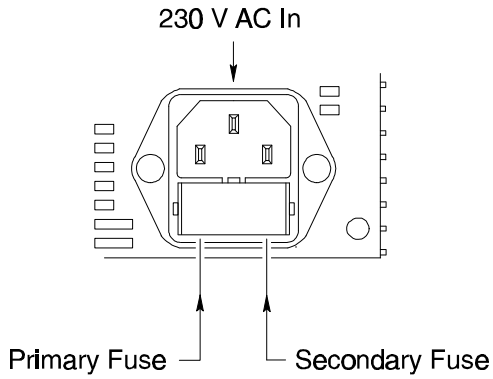
1.4 Power Supply

Power Supply: Types SMDxxx1 and SMDxxx2



Voltage Range	
SMD10xx	12-45VDC
SMD15xx	15-85VDC
SMD30xx	15-155VDC

Power Supply: Types SMDxxx3 and SMDxxx4



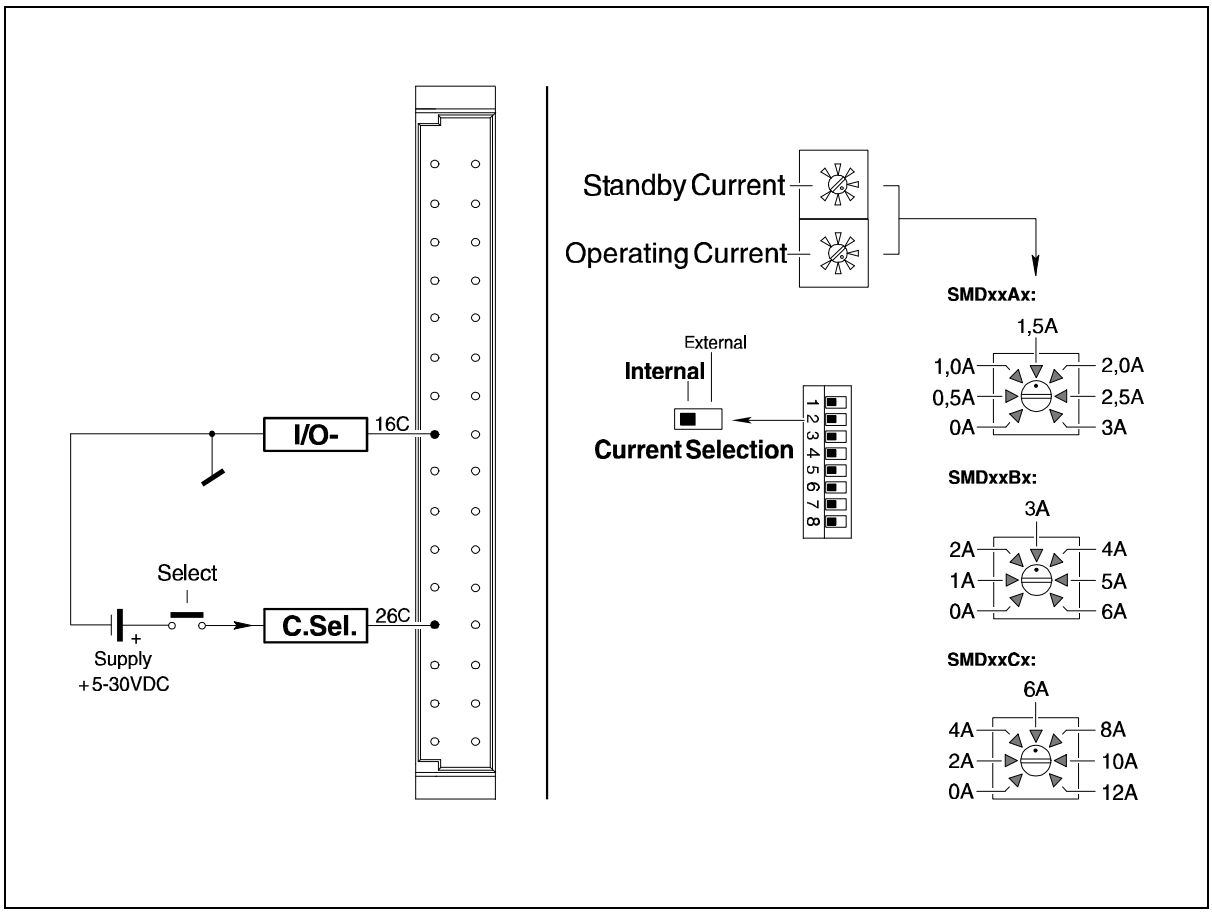
Fuse Size	Primary	Secondary
SMD10xx	T2A	T4A
SMD11xx	T3.15A	T6.3A
SMD15xx	T2A	T4A
SMD30xx	T2A	T4A

Supply (Drivers without Integral Power Supply).
To ensure that powering the Drivers is as simple as possible, models which do not include an integral mains power supply are powered from a single supply voltage. The internal circuitry ensures the correct voltages for the motor output driver, control circuits. etc.
In the event that the supply is connected with incorrect polarity or an overload occurs, the Drivers are fuse-protected. In such cases, the Driver should be disconnected from the supply and the fuse replaced. It is recommended that the external supply used to power the Driver is equipped with a capacitance of min. 2000-5000µF connected across the positive (P+) and negative (P-) terminals. It is also recommended that 0.75mm² cables (min.) are used to connect the Driver to the supply. If the Driver supply voltage falls below 10V, the Driver will be reset. Precautions should therefore be taken to ensure that the supply voltage is maintained in the range 12-15V, even if a mains voltage drop occurs.

Supply (Drivers with Integral Power Supply)**.**
Types SMDxxx3 and SMDxxx4 are equipped with an integral power supply for direct connection to a 230V AC mains supply.
The Driver's internal supply voltage is available via an external terminal and can thus be used for supplying other Drivers included in the motion control system.

If a mains overload occurs, the Driver's overload protection circuitry will be activated and either the primary or secondary fuse will be blown. If an overload occurs, the Driver should be disconnected from the mains supply and the fuse replaced.
The Driver's primary and secondary fuse holders are located below the mains supply connector (see above illustration).

1.5 Adjustment of Motor Phase Current



The Standby and Operating current supplied to each of the step motor's phases can be adjusted using 2 potentiometers on the front panel of the Driver.

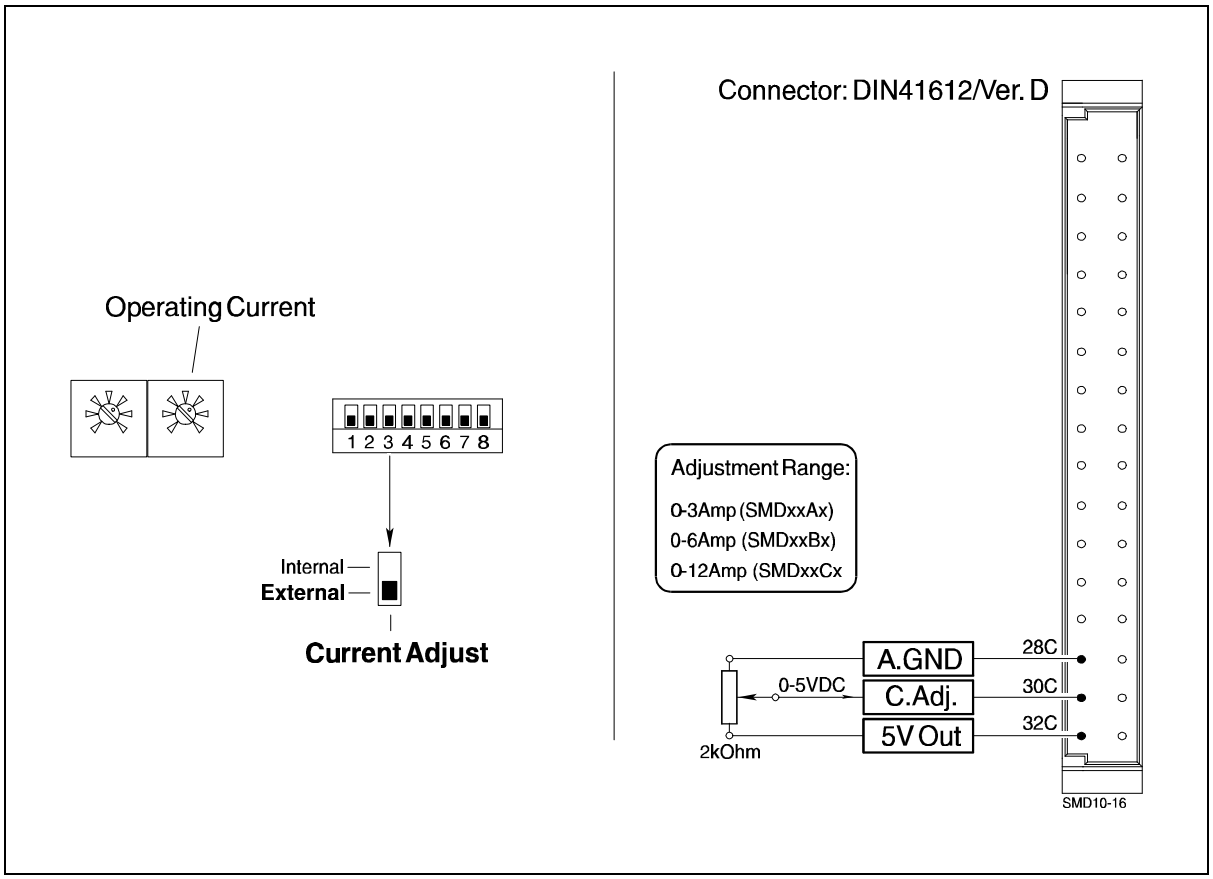
Typically the motor phase current should be adjusted to provide a significantly higher operating current, since the motor requires greater power to overcome its inertia during acceleration and constant speed.

The operating current can either be adjusted using the potentiometer or controlled via an externally applied voltage (see following page).

Switching between Standby Current and Operating Current is achieved in the following way:

1. Either by allowing the Driver to control the current supply. This is done by setting the *Current Selection* DIP switch to *Internal* (see above illustration). The Driver then automatically switches between Standby Current and Operating Current when the motor is started or stopped.
2. Or by controlling the motor current via an external control signal. This is done by setting the *Current Selection* DIP switch to *External*. Switching between motor Standby Current and Operating current is then determined by the signal applied to the *C.Sel (Current Select)* Input. If this Input is set to logic "0", the preset Standby Current is selected. If the Input is logic "1", the preset Operating Current is selected.

1.5 Adjustment of Motor Phase Current



To control the value of the motor phase current using an external control signal, the Driver's *C.Adj* (Current Adjust) Input can be used.

The *C.Adj* Input is used to apply an analogue control voltage in the range 0-5V DC corresponding to a motor phase current of 0 to 3A for Driver Types SMDxxAx, 0 to 6A for Types SMDxxBx, and 0 to 12A for Types SMDxxCx.

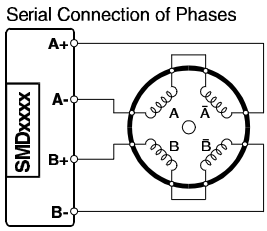
Note that the *C.Adj.* Input can only be used as an alternative to the trimmer potentiometer for adjusting the motor Operating Current. Internal or external control of the Operating Current is selected using the *Current Adjustment* DIP switch (see above illustration).
If the DIP switch is set to *External*, the *C.Adj* Input is used for adjusting the motor Operating Current.

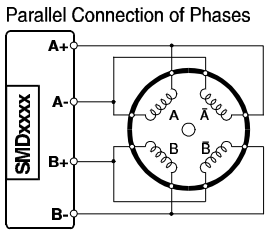
If the DIP is set to *Internal*, the Operating Current is determined by the setting of the trimmer potentiometer on the Driver front panel.

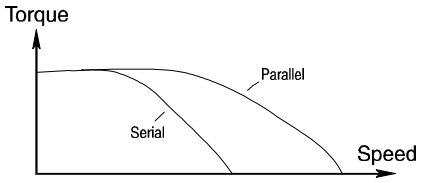
To control the Input using a signal in the range 0-20mA, a 250 Ohm resistor should be connected between *A.GND* (Analogue Ground) and the *C.Adj* Input.

A *5V Out* Output is also provided which supplies a voltage of 5V DC. This output is used if it is required to connect a potentiometer to the *C.Adj* Input. It is recommended that the *5V Out* output is used if only one power supply is available and is being used for other purposes and therefore a potential source of noise.

1.6 Connection of Step Motor







Current for Serial and Parallel

	Maximum Current-Adjustment	Example : Motor 4.2A
Motor 4 phase Parallel	I x 1.41	4.2 x 1.41 = 6A
Motor 4 phase Serial	$\frac{I}{1.41}$	$\frac{4.2}{1.41} = 3A$
Motor 2 phase	I	4.2A

I = Nominal rated motor current as specified by manufacturers

Various types of Step Motor are available:

1. 2-phase Bipolar (4 cables)
2. 4-phase Bipolar/Unipolar (8 cables)
3. 4-phase Unipolar (6 cables). Not suitable.

Note: Type 3 motors above (Unipolar) are not suited for operation with JVL Drivers since the Drivers use the Bipolar principle. Bipolar systems typically provide 40% greater torque than unipolar systems.
2-phase and 4-phase step motors can be connected to the Drivers as follows:

2-Phase Motors (4 cables).
This type of step motor can be directly connected to the Driver's output. The Driver current adjustment must not exceed the specified rated current for the motor.

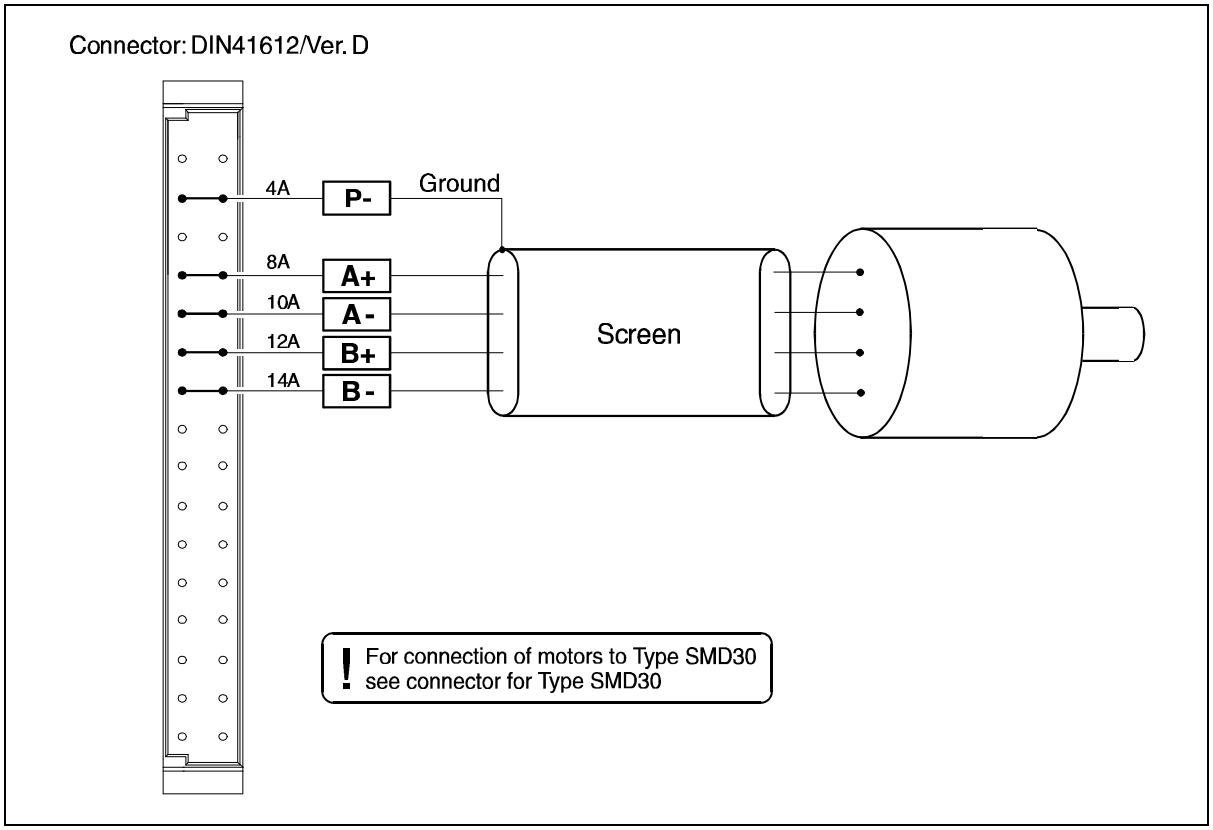
4-Phase Motors (8 cables).
This type of step motor can be connected to the Drivers in the two following ways:
1. Serial connection of phases.
2. Parallel connection of phases.

Selection of serial- or parallel connection is typically determined by the speed requirements of the actual system.
If slow speeds are required (typically less than 1kHz), the motor phases can be connected in serial. For operation at higher speeds (greater than 1 kHz), the motor phases can be connected in parallel.

Serial Connection:
Using serial connection of the phases, a motor provides the same performance (up to 1kHz) as parallel connection, but using only approximately half the current. This can influence the selection of Driver type, enabling a Driver rated for a lower motor current to be used. See above illustration.
If the phases of a 4-phase motor are connected in serial, the motor's rated current should be divided by 1.41. For example, if the rated current is 4.2A, the maximum setting of the Driver current trimmer potentiometers must not exceed 3A when the phases are connected in serial.

Parallel Connection.
With parallel connection of motor phases, a motor will provide better performance at frequencies above 1kHz compared to serially connected phases, but requires approximately twice the current. This can influence the choice of Driver since it is necessary to select a Driver which can supply twice the current used for a serial phase configuration. See above illustration. When the phases of a 4-phase motor are connected in parallel, the specified rated current of the motor must be multiplied by a factor of 1.41. For example, if the rated current is 4.2A, the maximum setting of the Driver current trimmer potentiometer must not exceed 5.9A when the phases are connected in parallel.

1.6 Connection of Step Motor



It should be noted that the lower the self-inductance of a step motor the better, since this influences the torque at high speeds. The torque is proportional to the current supplied to the motor as follows:

$$\text{Current} \approx \text{Torque} \approx \frac{\text{Applied Voltage}}{\text{Phase Induction x Frequency}}$$

The applied voltage is regulated by the Driver so that the phase current is adjusted to the selected value.

In practice this implies that if a motor with a large self-inductance (e.g. 100mH) is used, the Driver cannot supply the required phase current at high speeds (high rotational frequencies) since the output voltage is limited.

Cabling.

For Driver models which supply a phase current in the range 0 to 6A, it is recommended that 0.75mm² cable (minimum) is used to connect the motor to the Driver.

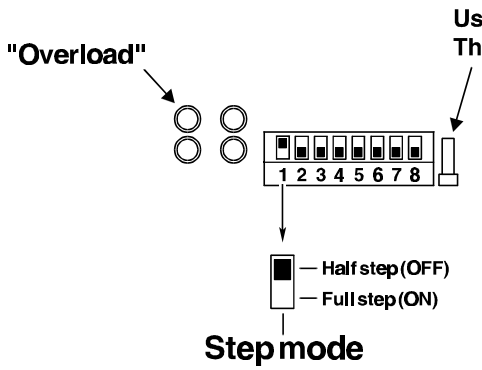
For Driver models which supply a phase current of 0 to 12A, it is recommended that 1.5mm² cable (minimum) is used.

Cable lengths used to connect the motor to the Driver should not exceed 10 metres because of impedance loss.

Important !

To minimise noise interference from the motor cables, screened cable should be used to connect the Driver to the motor. If screened cables are not used, electronic interference of other equipment in the system can occur.

1.7 Motor Step Resolution



Step resolution (only driver type SMD15xx)

Dip Switch 1	Jumper	Resolution
ON	Rear position.	200 step/rev.
OFF	Rear position	400 step/rev.
ON	Front position	800 step/rev.
OFF	Front position	1600 step/rev.

The Driver can be configured for either Full- or Half Step motor operation. The driver type SMD15 can additionally be set to the resolutions 1/4 step or 1/8 step. Often it can be an advantage to operate with higher step resolutions than half step since each motor revolution is divided into smaller and more precise steps. This often eliminates the need for mechanical gearing.

Another significant advantage of 1/4 or 1/8 Step operation is that the motor resonance which may be encountered with Full-Step operation can normally be avoided. The resonance frequency of a step motor depends on the applied load and results in complete loss of torque.
For large motors, the resonance frequency will normally be outwith the normal operating range (the frequencies in which the motor is accelerated or decelerated).
Configuration of the Driver for Full- or Half Step operation is set using the *Step Mode* DIP switch as shown in the above illustration:

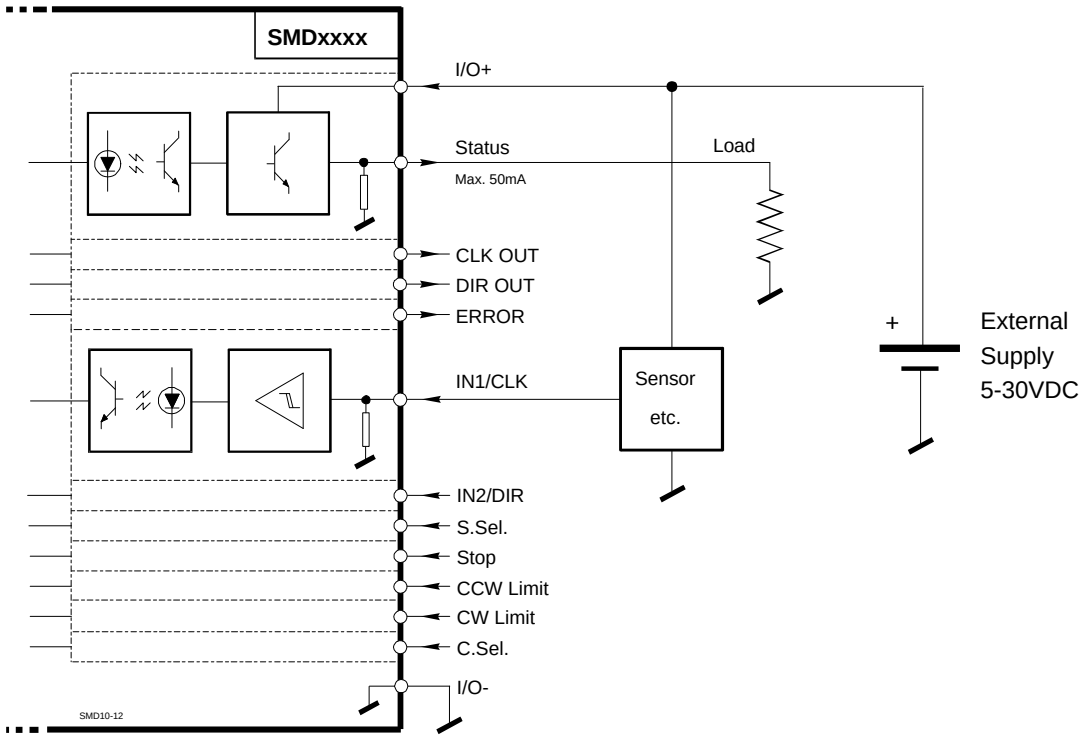
Overload Protection

The Drivers are short-circuit protected. If the peak current exceeds the Driver's maximum current by +20% for a period greater than 2ms, the output voltage to the motor is disconnected. An instantaneous short-circuit of any two output terminals will not damage the Driver; the *Overload* LED (see above illustration) will simply indicate that an overload has occurred. The supply voltage to the Driver must then be disconnected for a period of 5 seconds to reset the Driver.

Note: ! The Driver is not protected against short-circuits to ground (P-).

1.8 Inputs and Outputs

Overview of Digital Inputs and Outputs



To provide maximum flexibility for a variety of applications, the Drivers are equipped with 7 inputs and 4 outputs. All Inputs and Outputs are optically isolated from other Driver circuitry to ensure that electrical interference from motors and other equipment does not influence the input signals.

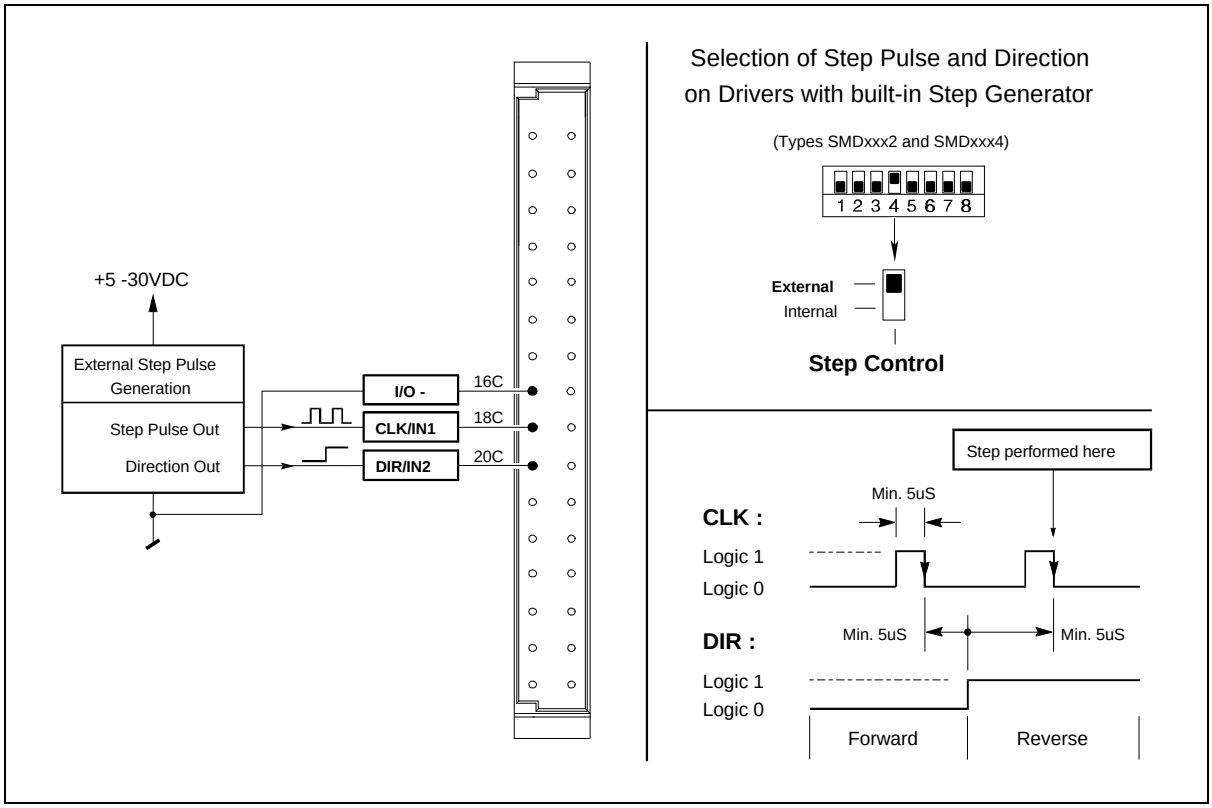
In addition, the Drivers are equipped with 2 analogue inputs.

All digital User Inputs and Outputs operate with voltages in the range 5 to 30V DC.

It should be noted that each of the 7 User Inputs is deactivated (logic "0") if no connection is made.

Some types of inductive sensors utilise an open-collector output. For sensors with NPN output, a resistor should be connected between the Input and the positive (+) supply. For PNP sensors, a resistor should be connected between the Input and ground. It is recommended that a resistor of 500 Ohm to 5kOhm is used, depending on the supply voltage.

1.9 Step Pulse and Direction Inputs



IN1/Step Pulse Input

IN2/Direction Input

The Step Pulse and Direction Inputs of the Driver have 2 different functions depending on the Driver Type and DIP switch configuration. For Driver models without a built-in Step Generator (Types SMDxxx1 or SMD10xxx3), the Inputs can only be used as Step Pulse and Direction Inputs. For Driver models with a built-in Step Generator (Types SMDxxx2 or SMDxxx4), the Inputs can also be used for controlling the Step Generator. (See Chapter 2.) The Step Pulse and Direction Inputs enable the Driver to be controlled using an external signal to control each motor step. This requires however that the external control system assumes complete control of motor speed and positioning.

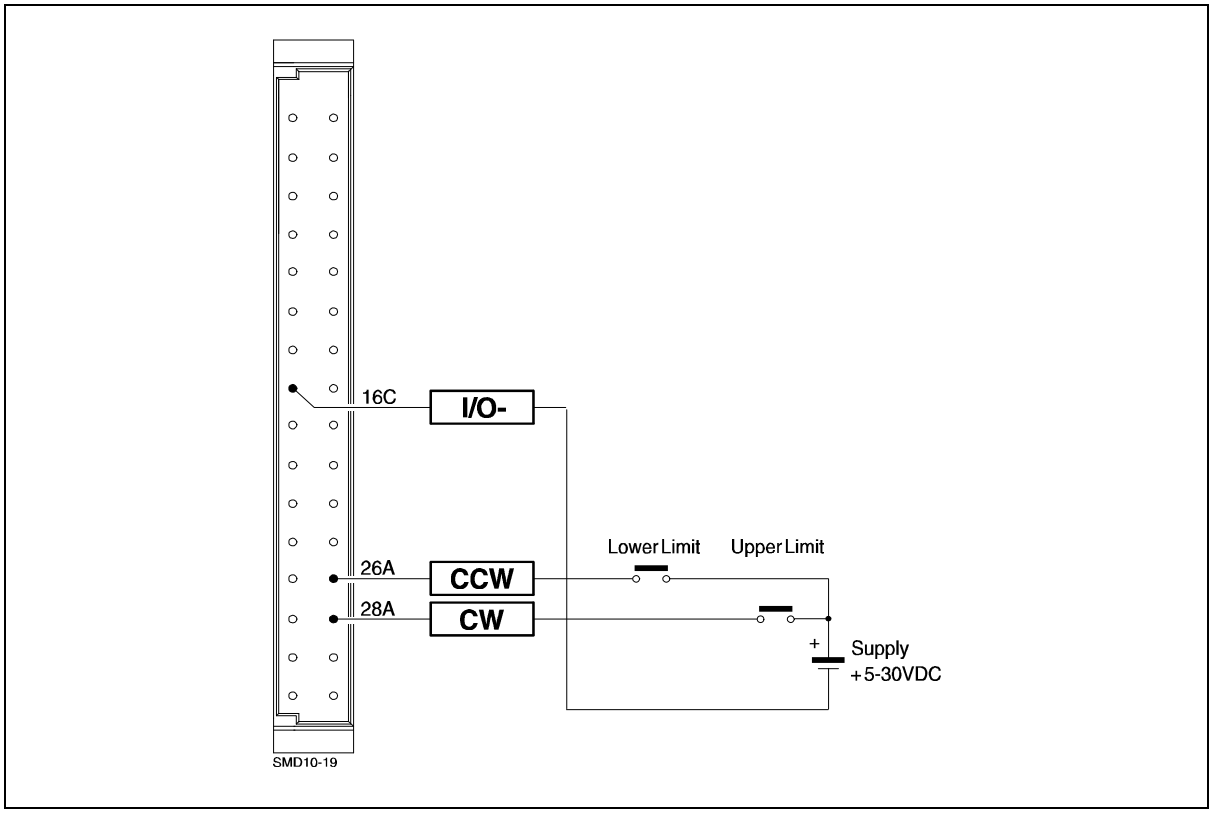
In contrast, Drivers with a built-in Step Generator use the generator for acceleration, etc., - i.e. primarily for start and stop sequences and not precise motor positioning. See Chapter 2.

In order to use the Step Pulse and Direction Inputs with Drivers equipped with a built-in Step Generator, the *Step Control* DIP switch (see illustration) must be set to *External*.

Step Pulse and Direction Inputs

A voltage pulse must be applied to the Step Pulse Input for each motor step. A step is made when the voltage at the Input is switched from logic "1" to logic "0" (triggering on the trailing edge). The Direction Input determines the direction of motor movement. The status of the Direction Input must be well defined when the Step Pulse is applied (see above illustration). If the Direction Input is logic "0", the motor will advance; if the Input is logic "1", the motor reverses. The Step Pulse and Direction Inputs are optically isolated from the Driver supply, and voltages of 5-30 V can be applied to both Inputs (see Specifications). Note that both Inputs must be controlled from a *source/PNP* output or *push-pull* output.

1.10 CW/CCW Limit Inputs



End-of-Travel Inputs

In step motor systems it is often necessary to establish certain mechanical limits which must not be exceeded by motor movement.

To enable end-of-travel limits to be established, the Drivers are equipped with 2 inputs: *CW* (Clockwise Limit) and *CCW* (Counter Clockwise Limit).

Depending on the actual direction of motor rotation, one of these two Inputs will stop motor operation when the Input is activated.

Note that activation of either of the *CW* or *CCW* Inputs results in an instantaneous stop of the motor, regardless of any preset deceleration ramp.

CCW Limit Input

If the motor is rotating counter clockwise and the *CCW Limit* Input is activated (logic "1"), the motor is stopped instantaneously. The *CW Limit* Input has no effect during counter clockwise rotation.

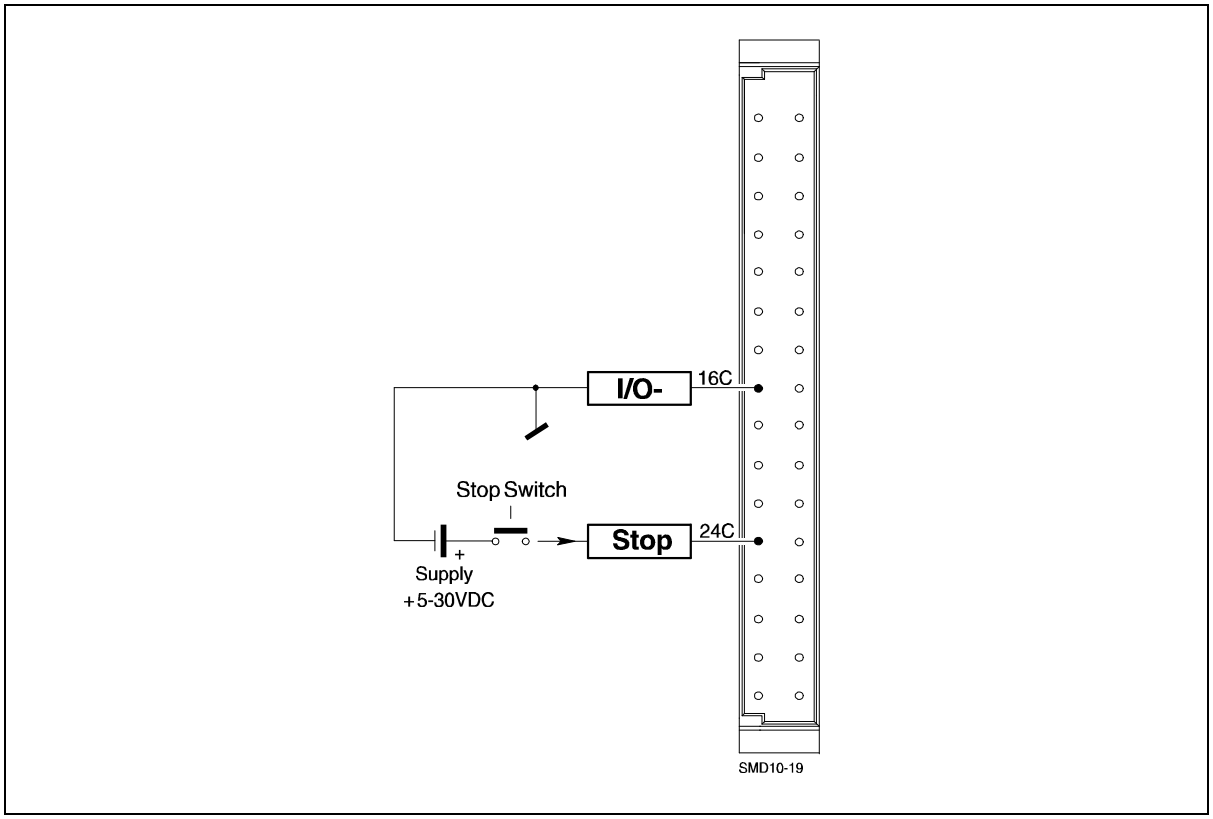
CW Limit Input

If the motor is rotating clockwise and the *CW Limit* Input is activated (logic "1"), the motor is stopped instantaneously. The *CCW Limit* Input has no effect during clockwise rotation.

The *Error* Output and *Error* LED are activated when either the CW or CCW Limit Input is used to stop motor operation.

If either of the Limits Inputs is not used, it will be inactive (logic "0") and thus have no effect on motor operation.

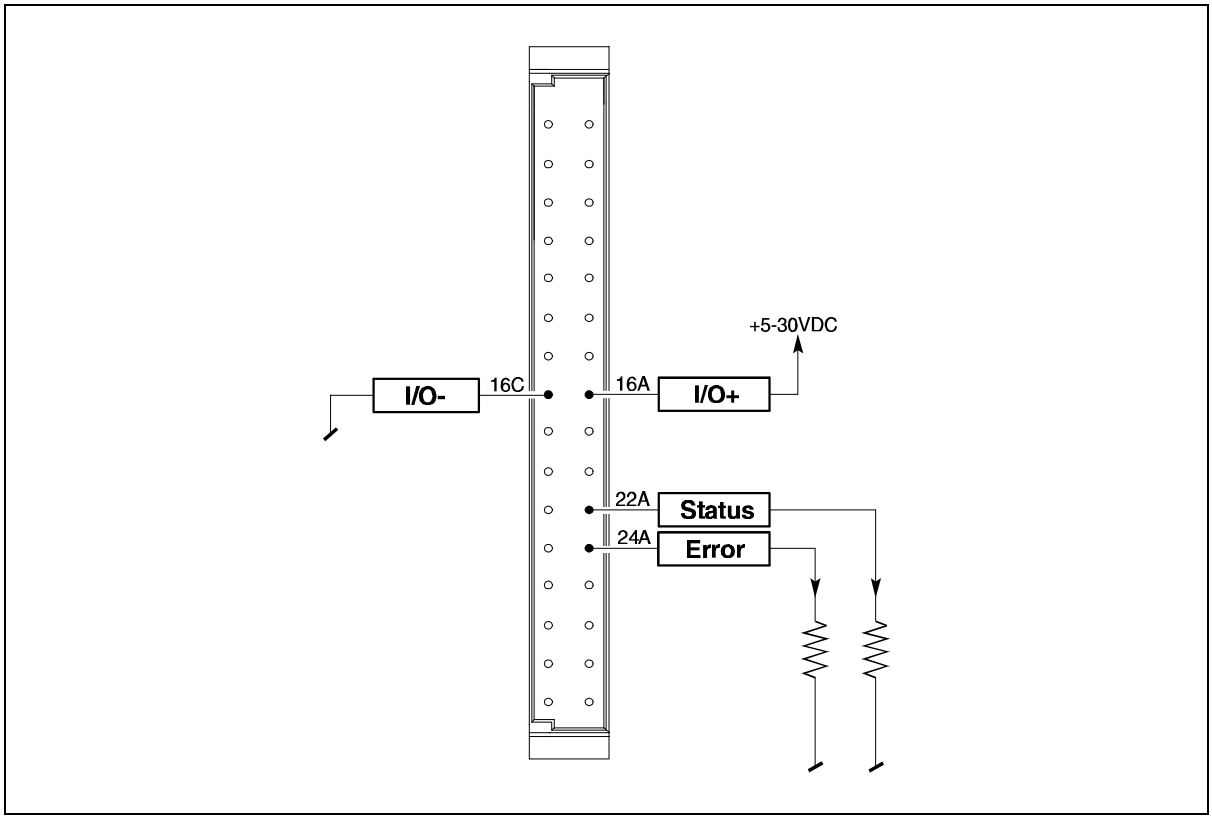
1.11 Stop Input



The Stop Input is used to stop motor operation instantaneously regardless of the direction of rotation. To stop the motor using the Stop Input, the Input is activated (logic "1").
If the Stop Input is deactivated (logic "0"), motor operation will continue. However, the instantaneous stop will most likely have resulted that the motor has an undefined position since activation of the Stop Input does not take account of any acceleration/deceleration ramp.

If no connection is made to the Stop Input, it is inactive and has no effect on motor operation.

1.12 Status and Error Outputs



Status Output

The Status Output enables PLC equipment, for example, to sense if the motor is stopped or running. When the motor is operating, the voltage at the Status Output is logic "0". When the motor is stationary, a voltage of 5-30V is output at the Status Output, depending on the user supply. The maximum rated current at the Output is 50 mA. Note that the Status Output is not short-circuit protected. It is however protected against inductive transients, for example from magnetic valves, etc.

Error Output

The Error Output is used to indicate that an error condition preventing normal operation of the Driver has occurred.

The Error Output is activated (logic "1") in the following cases:

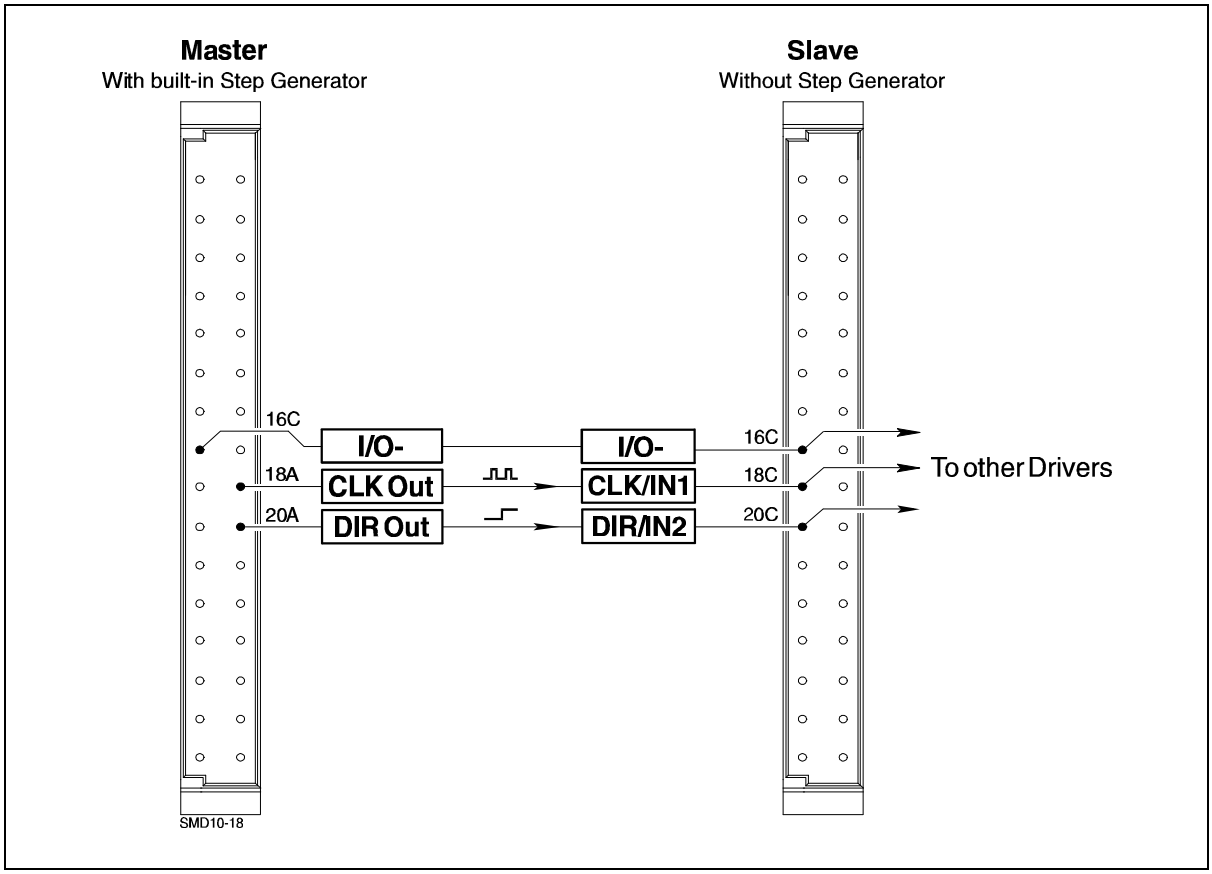
1. One of the two end-of-travel inputs (*CW Limit* or *CCW Limit* Inputs) has been activated (logic "1").

2. The Stop Input has been activated (logic "1").

3. The Driver motor output has been overloaded/short-circuited.

The maximum rated current at the Output is 50mA. The Error Output is not short-circuit protected.

1.13 Step Pulse and Direction Outputs



Step Pulse Output (CLK) and Direction Output (DIR).
The Step Pulse and Direction Outputs enable several step motor Drivers to be driven synchronously.

The Outputs can be used if two or more step motors are required to operate at precisely the same speed, for example for synchronous operation of two conveyors. In this case a Driver with an integral Step Generator can be used as a Master Driver and a second Driver without a built-in Generator used as the Slave.

The Step Output outputs a voltage pulse each time the Driver moves the motor 1 step.

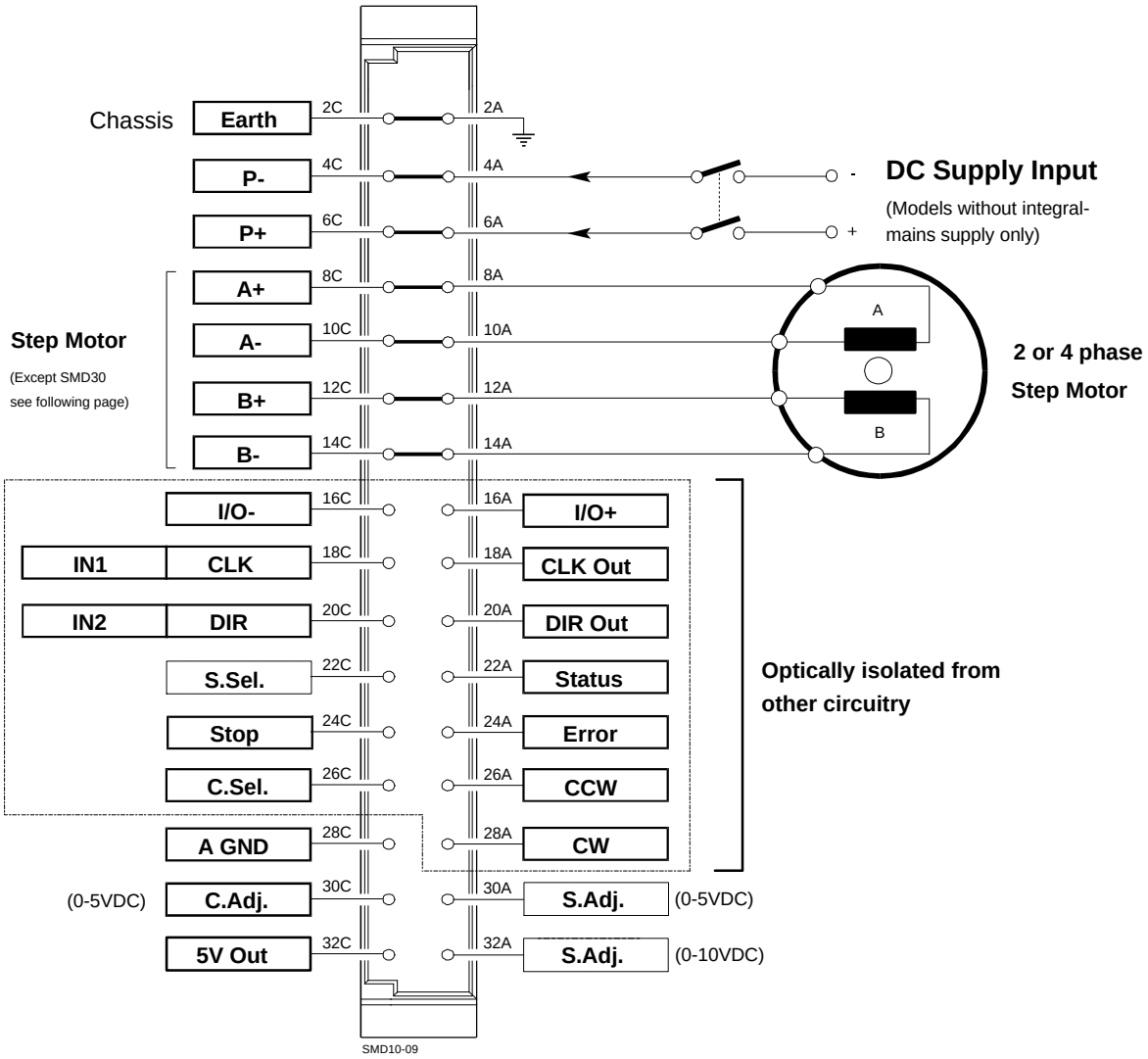
The Direction Output indicates the direction of motor movement. Logic "0" at the Output corresponds to clockwise motor movement; logic "1" corresponds to counter clockwise movement.

The maximum rated current of the Step Pulse and Direction Outputs is 50mA.

Note !
The Step Pulse and Direction Outputs are **not** short-circuit protected.

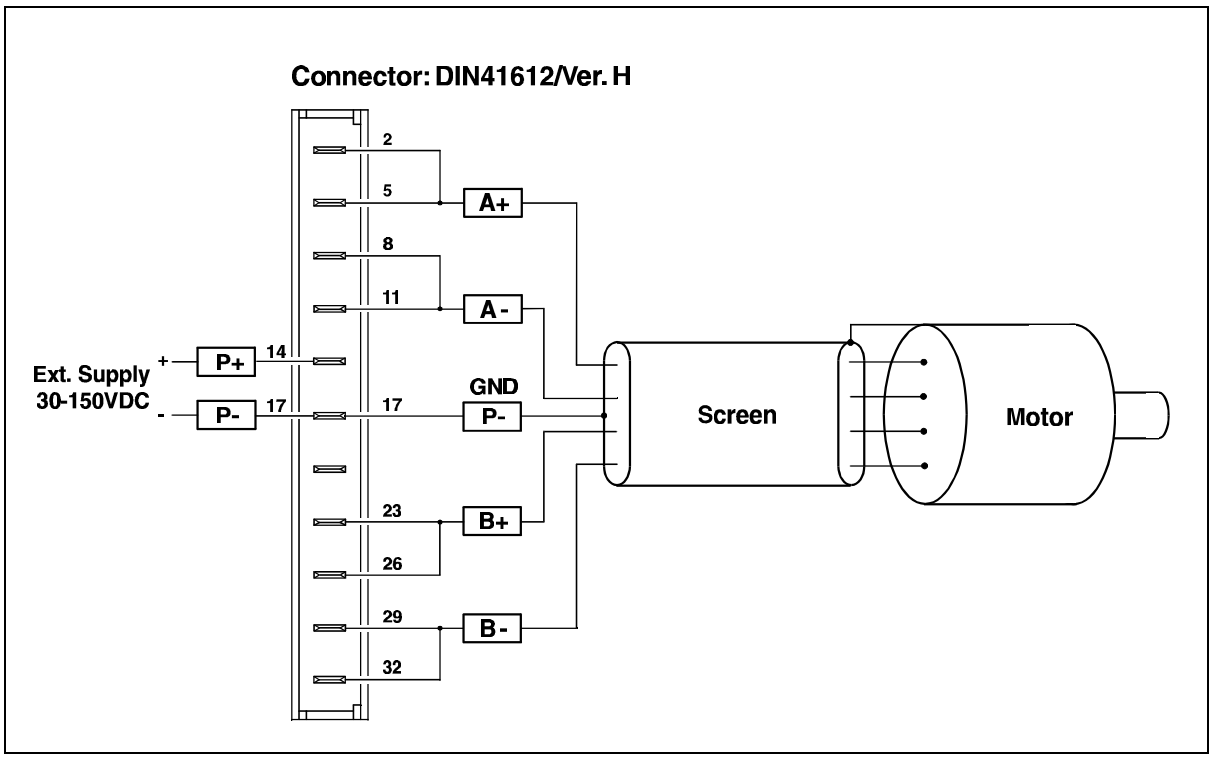
1.14 Overview of Driver Connections

SMD10, 11, 15, and 30 Connector (DIN41612 Ver. D)



= Driver models with built-in Step Generator only

1.14 Overview of Driver Connections (Only SMD30xx)



2.1 Step Generator

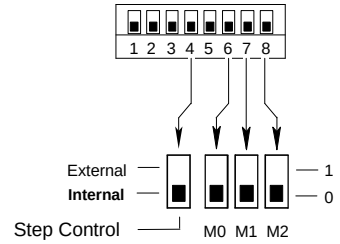
(Driver models with step generator only)

To control the Driver via an external control signal, for example from PLC equipment, the Driver's internal Step Generator can be used. The Generator then generates step pulses to drive the motor depending on the signals applied to the two Control Inputs *IN1* and *IN2*. A micro-controller ensures control of the Step Generator in accordance with the preset operating parameters: Start Rate, Acceleration/Deceleration time and Top Rate. Two independent Top Rate values can be preset for operating the motor at two different speeds in the same operation.

The Top Rate is selected via the *S.Sel* Input. In addition, Top Rate 2 can be adjusted by applying an external voltage to the *S.Adj.* Input. (See Section 2.2 for description of *S.Sel* and *S.Adj.*)

In order to use the Driver's internal Step Generator, the *Step Control* DIP switch must be set to *Internal* (see illustration below).

The *IN1* and *IN2* Inputs can be configured to start/stop the step generator in the following modes:



M0	M1	M2	Configuration
0	0	0	Mode 1
1	0	0	Mode 2
0	1	0	Mode 3
1	1	0	Mode 4
0	0	1	Mode 5
1	0	1	Mode 6
0	1	1	Reserved
1	1	1	Reserved

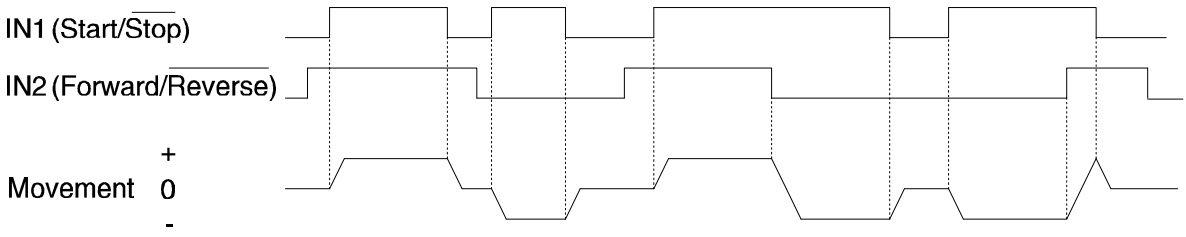
2.1 Step Generator

(Models with step generator only)

Mode 1 Operation

When the Step Generator is configured for operation in Mode 1, the logic level at the *IN1* Input controls start/stop operation of the motor. The logic level at the *IN2* Input determines the direction of movement. Mode 1 operation is illustrated below.

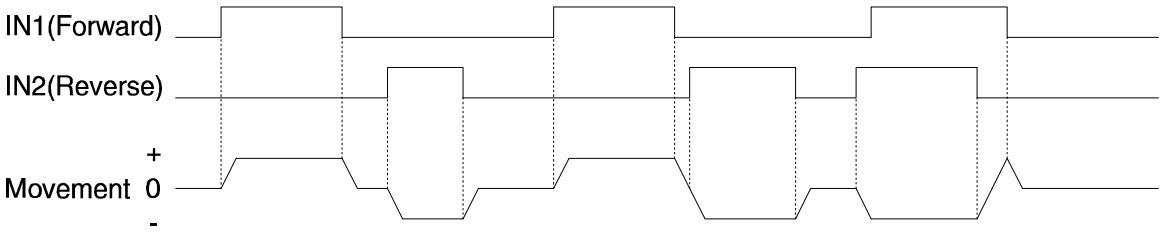
IN1 (Start/Stop): 0=Stop / 1=Start IN2 (Forward/Reverse): 0=Reverse / 1=Forward



Mode 2 Operation

For operation in Mode 2, the logic level at the *IN1* Input determines forward movement of the motor. The logic level at the *IN2* Input determines reverse movement of the motor. If both Inputs are set to logic "1", the direction of movement will be determined by the Input which was set logic "1" first. Mode 2 operation is illustrated below.

IN1 (Forward): 0=Passive / 1=Forward IN2 (Reverse): 0=Passive / 1=Reverse



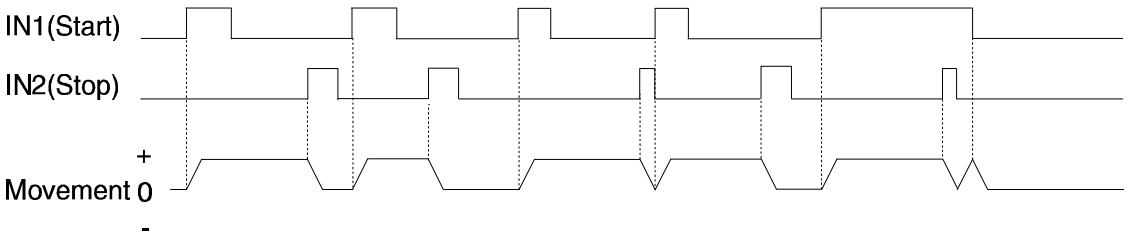
Mode 3 Operation

As for Mode 2 operation, but *IN1* and *IN2* are inverted logically.

Mode 4 Operation

For Mode 4 Operation, if the *IN1* Input is set to logic "1", forward motor operation is started. When the *IN2* Input is set to logic "1", motor operation is stopped. If both Inputs are activated, the motor will stop and/or remain stationary. Mode 4 operation is illustrated below.

IN1 (Start): 0=Passive / 1=start IN2 (Stop): 0=Passive / 1=stop

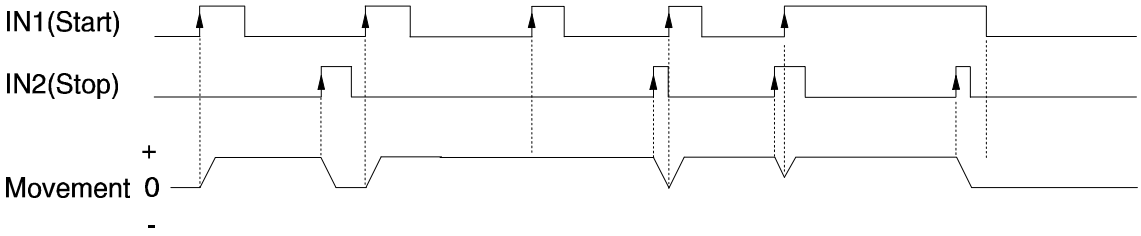


2.1 Step Generator (Models with step generator only)

Mode 5 Operation

Operation in Mode 5 is similar to Mode 4 Operation, but is flank-triggered. When the *IN1* Input is changed from logic "0" to logic "1", forward motor movement is started. When the *IN2* Input is changed from logic "0" to logic "1", the motor is stopped. If both inputs are changed to logic "1", the motor will remain stationary if the *IN2* Input was the last to be changed from logic "0" to logic "1". Mode 5 Operation is illustrated below.

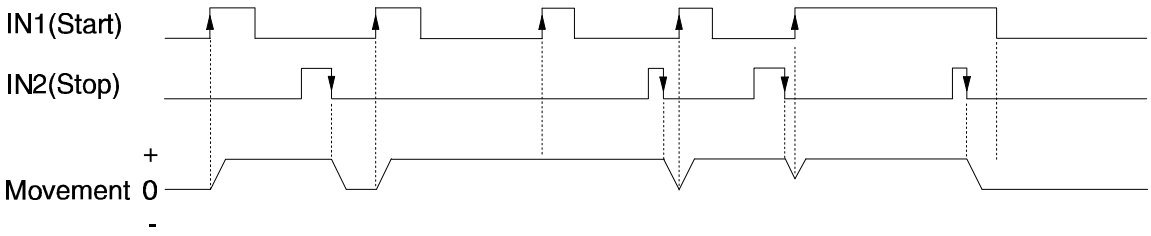
IN1 (Start): 0=Passive / 0 to 1=start IN2 (Stop): 0=Passive /0 to 1=stop



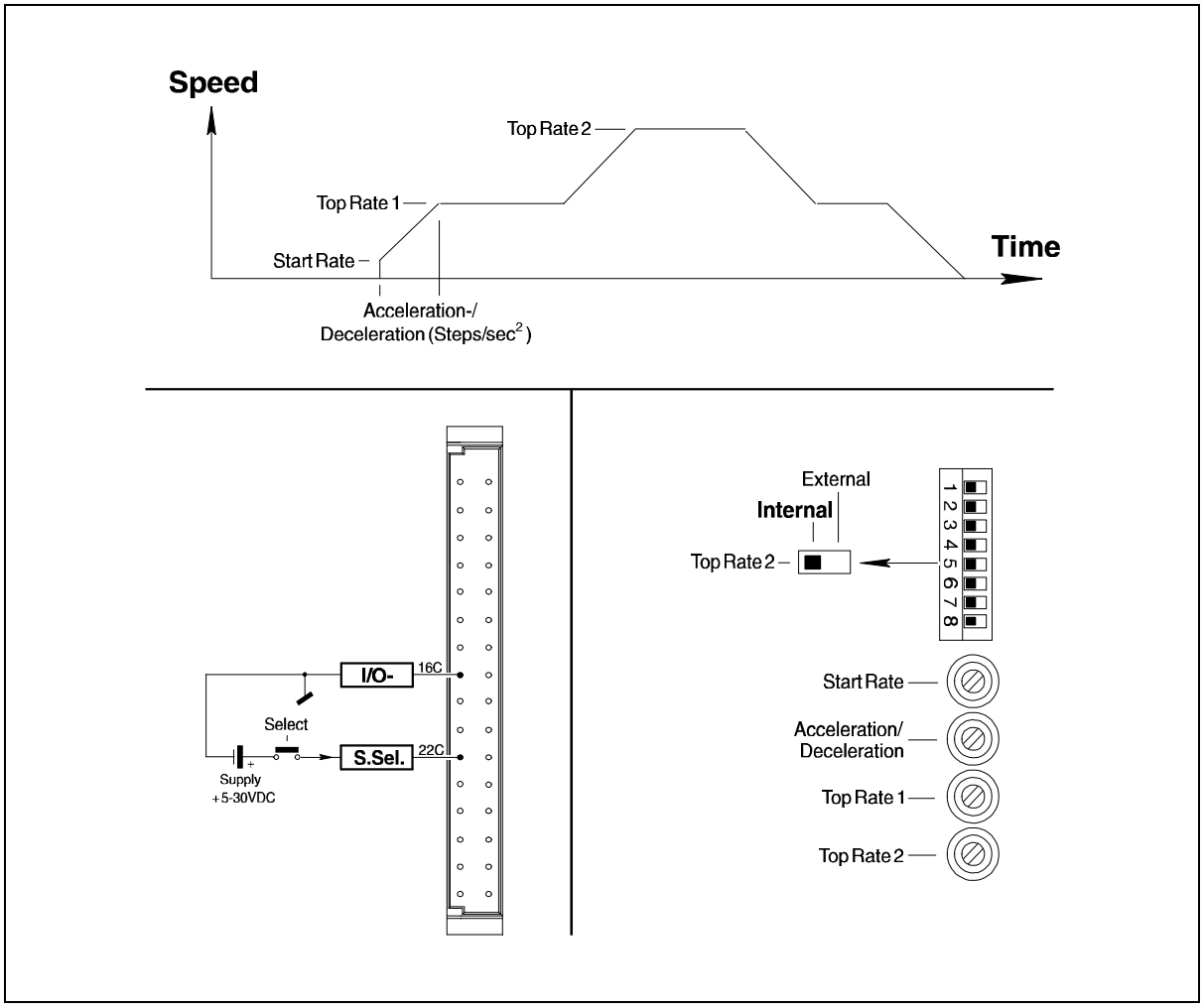
Mode 6 Operation

Operation in Mode 6 is similar to Mode 4 Operation, but is flank triggered. When the *IN1* Input is changed from logic "0" to logic "1", forward motor movement is started. When the *IN2* Input is changed from logic "1" to logic "0", the motor is stopped. Mode 6 Operation is illustrated below.

IN1 (Start): 0=Passive / 0 to 1=start IN2 (Stop): 0=Passive /1 to 0=stop



2.2 Adjustment of Parameters (Models with step generator only)



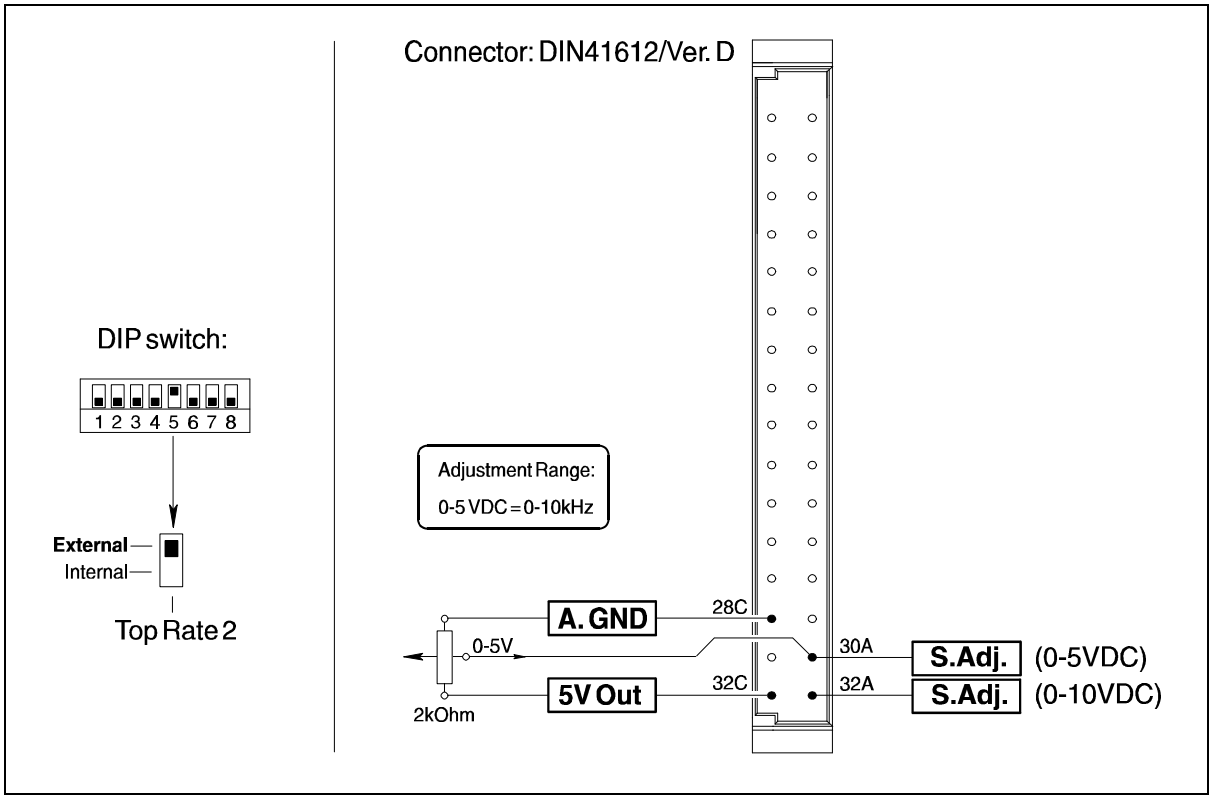
Adjustment of Motor Parameters

3 basic motor parameters can be adjusted: Start Rate, Top Rate 1 and acceleration-/deceleration. In addition, it is possible to set an alternative Top Rate (Top Rate 2). The motor Start Rate can be adjusted in the range 0-2000 steps/sec. The Acceleration can be adjusted in the range 8.600-1.200.000 steps/sec². The 2 motor Top Rates can be adjusted from 0 to 10000 steps/sec.

The above illustration shows the location of the trimmer potentiometers for adjusting motor parameters. Under normal conditions, the Driver operates the motor using the preset value of Top Rate 2, but the motor speed can be changed to Top Rate 1 by applying logic "1" to the *S.Sel* Input. The motor speed can be switched between Top Rate 1 and Top Rate 2 at any time, even during motor operation.

Note that the Top Rate 2 DIP switch must be set to *Internal* to adjust Top Rate 2 using the trimmer potentiometer.

2.2 Adjustment of Parameters (Model with step generator only)



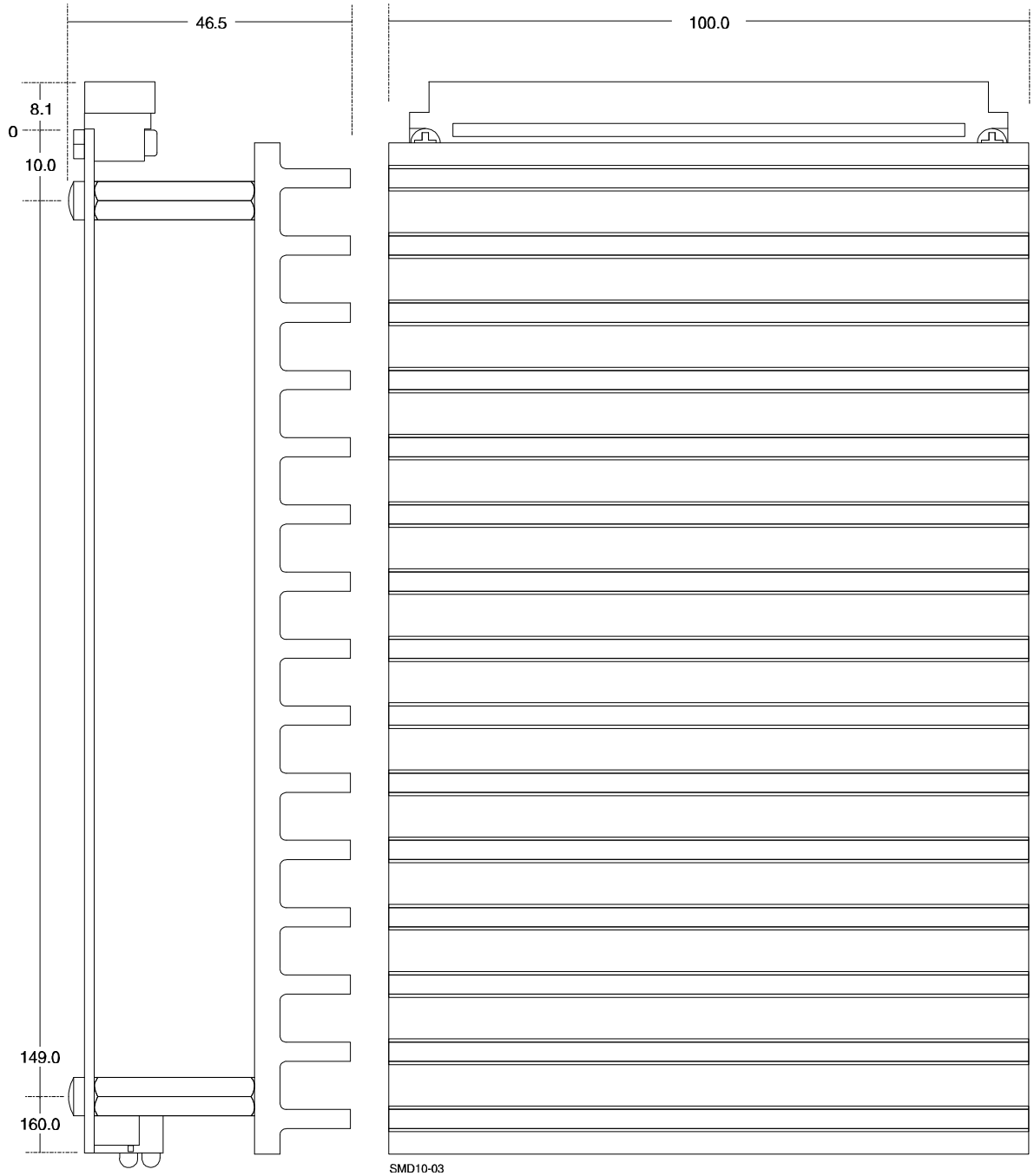
To control the top speed of a motor using an externally applied voltage, the *S.Adj. (0-5V)* and *S.Adj. (0-10V)* Inputs can be used (see illustration).

An analogue voltage in the range 0-5V DC or 0-10V DC corresponding to a top speed of 0 to 10000 steps/sec can be applied to one of these Inputs. Note that only 1 of the *S.Adj* Inputs can be used, depending on the available control voltage signal.

Note that only the value of Top Rate 2 can be controlled using the *S.Adj* Inputs. To enable analogue control of Top Rate 2, the *Top Rate 2* DIP switch (switch 5) must be set to *External.*
When the motor speed is changed using an external control signal, the Driver ensures that the preset acceleration/deceleration value is not exceeded.

To control the Inputs using a signal of 0-20mA, a 250 Ohm resistor should be connected between *A.GND* (Analogue Ground) and the *S.Adj. (0-5V)* Input.
A 5V DC voltage output, *5V Out,* is available for external purposes.
The *5V Out* output is used if it is required to connect a potentiometer to the *S.Adj.* Input. It is recommended that the *5V Out* output is used if only 1 power supply is available and is being used for other purposes and therefore a potential source of noise.
The maximum rated current of the *5V Out* Output is 50mA.

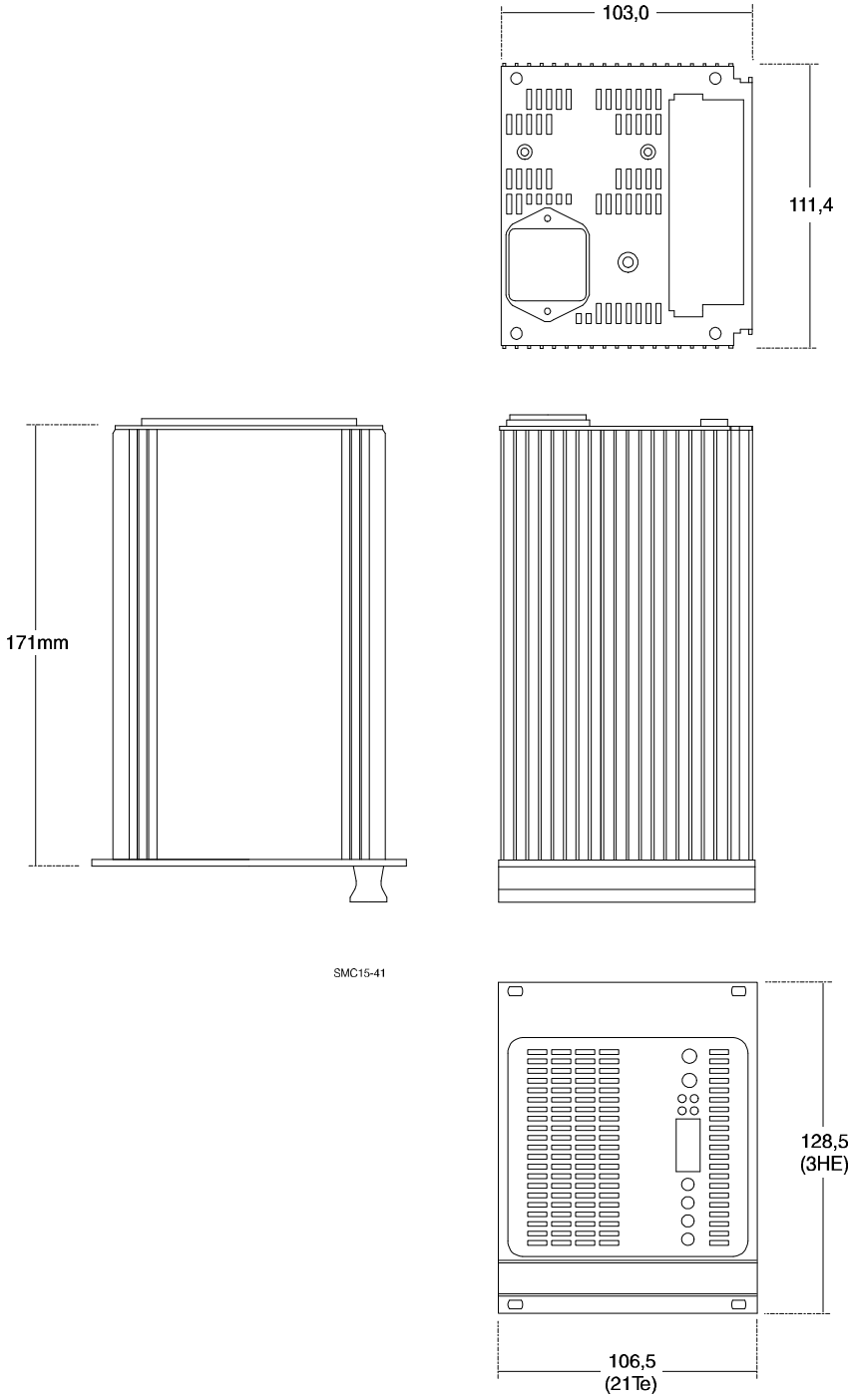
3.1 Physical Dimensions (Types SMD10/15_1, SMD10/15_2 only)



Scale 1:1
Dimensions in mm
Tolerances: +/-0.3mm

If the Driver is mounted in a closed cabinet, a fan or other form of ventilation should be installed. The Driver is however protected against overheating. Built-in thermal protection disconnects the Driver stages at a temperature of approximately 80°C.

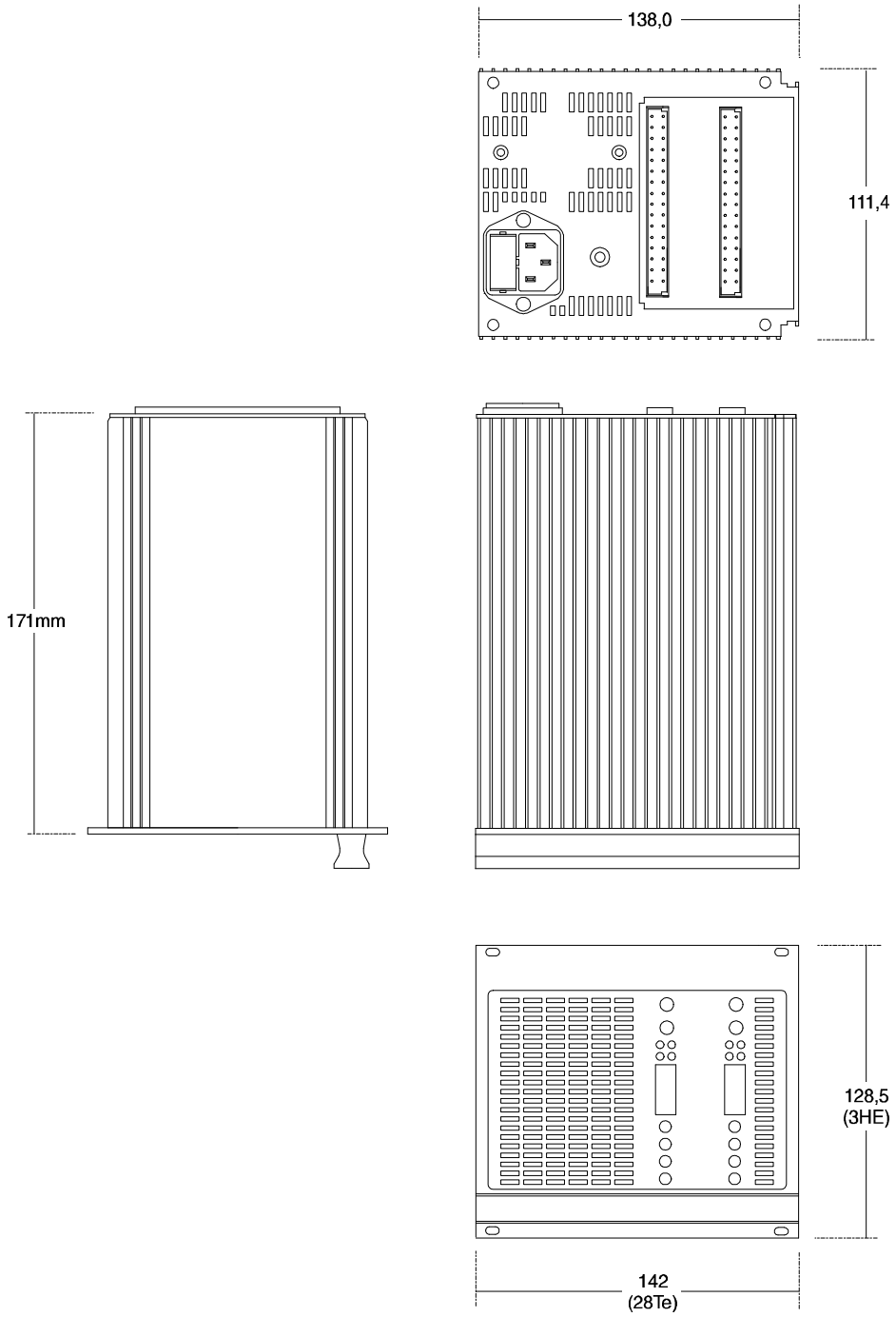
3.1 Physical Dimensions (Types SMD10/15_3, SMD10/15_4 only)



If the Driver is mounted in a closed cabinet, a fan or other form of ventilation should be installed. The Driver is however protected against overheating. Built-in thermal protection disconnects the Driver stages at a temperature of approximately 80°C.

3.1 Physical Dimensions

(Types SMD11xx only)



If the Driver is mounted in a closed cabinet, a fan or other form of ventilation should be installed. The Driver is however protected against overheating. Built-in thermal protection disconnects the Driver stages at a temperature of approximately 80°C.

3.2 Electrical Specifications

	Min.	Typ.	Max.	Units
Power Supply : (SMD10A1/SMD10A2) (SMD10B1/SMD10B2)				
Supply Voltage/Driver Voltage	12		45	V DC
Power Consumption (unloaded, without motor)		2		W
Power Supply : (SMD10x3/SMD10x4)				
Supply Voltage	207		241	V AC
Driver Voltage		40		
Power Consumption (unloaded, without motor)		4.2		W
Power Supply : (SMD11x3/SMD11x4)				
Supply Voltage	207		241	V AC
Driver Voltage		40		
Power Consumption (unloaded, without motor)		6.2		W
Power Supply : (SMD15B1/SMD15B2)				
Supply Voltage/Driver Voltage	15		85	V DC
Power Consumption (unloaded, without motor)		2.5		W
Power Supply : (SMD15B3/SMD15B4)				
Supply Voltage	207		241	V AC
Driver Voltage		75		
Power Consumption (unloaded, without motor)		4.5		W
Power Supply : (SMD30C1/SMD30C2)				
Supply Voltage/Driver Voltage	15		150	V DC
Power Consumption (unloaded, without motor)		5		W
Power Supply : (SMD30C3/SMD30C4)				
Supply Voltage	207		241	V AC
Driver Voltage		145		
Power Consumption (unloaded, without motor)		7		W

3.2 Electrical Specifications

	Min.	Typ.	Max.	Units
Digital Inputs (20C,22C,24C,26C,26A,28A):				
Input Impedance	3.0		3.5	kOhm
Allowable Voltage	-1.0		30.0	V DC
Input Current @ 5V DC		1.2		mA DC
@ 12V DC		3.3		mA DC
@ 24V DC		6.6		mA DC
Logic "0"			2.3	V DC
Logic "1"	4.2			V DC
Step Pulse/IN1 - Input (18C):				
Input Impedance	1.7		2.9	kOhm
Allowable Voltage	-1.0		30.0	V DC
Input Current @ 5V DC		2.7		mA DC
@ 12V DC		4.6		mA DC
@ 24V DC		9.0		mA DC
Logic "0"			1.9	V DC
Logic "1"	4.2			V DC
Pulse Duration - logic "0"	5			µS
Pulse Duration - logic "1"	5			µS
Step Frequency	0		20	kHz
Outputs (18A,20A,22A,24A):				
Supply Voltage	4.5		30	V DC
Rated Current			50	mA DC
Analogue Inputs (30C,30A) :				
Input Voltage	-0.5		5.5	V DC
Input Impedance		4.7		kOhm
Analogue Input (32A) :				
Input Voltage	-0.5		10.5	V DC
Input Impedance		9.4		kOhm
Miscellaneous :				
Ambient Temperature (SMDxxx1/SMDxxx2)	0		50	°C
Ambient Temperature (SMDxxx3/SMDxxx4)	0		40	°C
Chopper Frequency	20		25	kHz
Phase Current (SMD10Ax)	0.1		3	Amp/phase
Phase Current (SMD10Bx)	0.1		6	Amp/phase
Phase Current (SMD11Bx)	0.1		6	Amp/phase
Phase Current (SMD15Bx)	0		6	Amp/phase
Phase Current (SMD30Cx)	0		12	Amp/phase

3.3 Electrical timing

For some purposes it can be important to know the delay times from the inputs of the driver to the outputs. The table below shows all the delay times between digital inputs and outputs.

		Outputs				
		Clock Out "CKO"	**Direction Out "DIO"**	**Status "STA"**	**Error "ERR"**	**Motor (A+, A-, B+, B-)**
Inputs	**Input 1 "IN1"**	**Min. 23µs Max. 155µs**	**Typ. 12µs**	**Typ. 350µs**	**No influence**	**Typ. 210µs**
	Input 2 "IN2"	*No influence*	**Typ. 1000ms**	**No influence**	**No influence**	**No influence**
	Clockwise limit "CW"	**Typ. 12µs**	**No influence**	**Typ. 100ms**	**Max. 80µs**	**Max. 60µs**
	Counter clock-wise limit "CCW"	**Typ. 12µs**	*No influence*	**Typ. 100ms**	**Max. 80µs**	**Max. 60µs**
	Stop "ST."	**Typ. 12µs**	**No influence**	**Typ. 100ms**	**Max. 80µs**	**Max. 60µs**
	Current select **"CS"**	**No influence**	**No influence**	**No influence**	**No influence**	**Max. 60µs**
	Speed select "SS" ①	**Typ. 12µs**	**No influence**	No influence	**No influence**	**Max. 60µs**

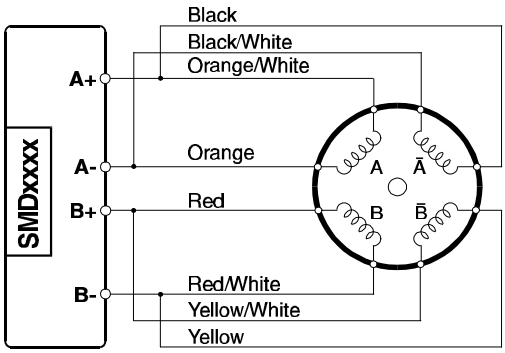
① *Delay to output is measured with a speed change from 1000 to 2000 step/sek.*

The delay times is specified under following conditions:

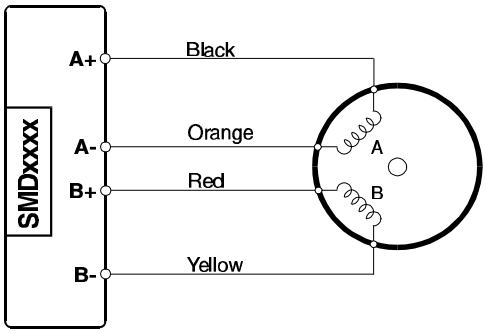
- Standby current = 1A
- Running current = 6A
- Motor running in half step
- Internal current selection and adjustment.
- Internal stepgenerator
- Stepgenerator in mode 0
- Startspeed = 500 steps/sec.
- Acceleration/deceleration = 500 step/sec².
- Topspeed 1 = 1000 steps/sec.
- Topspeed 2 = 2000 steps/sec.
- Temperature = 20°C.

3.4 Motor Connections

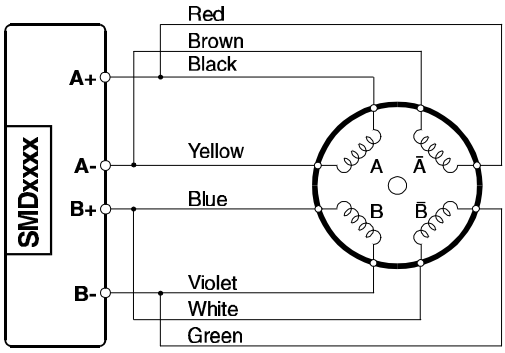
Connection of MAE motor Type HY200-xxxx-xxx-x8



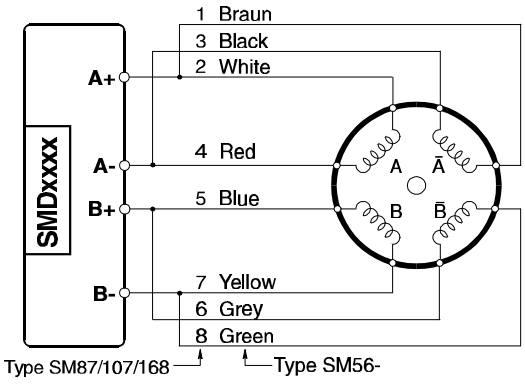
Connection of MAE motor Type HY200-xxxx-xxx-x4



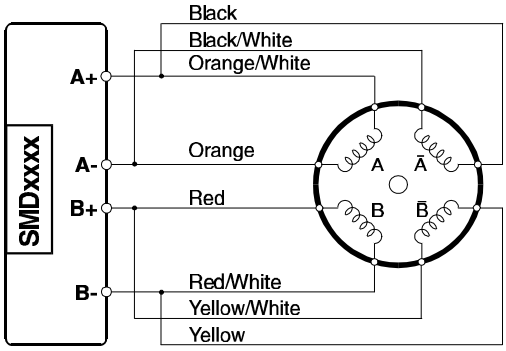
Connection of Phytron motor Type ZSx . xxx.x,x



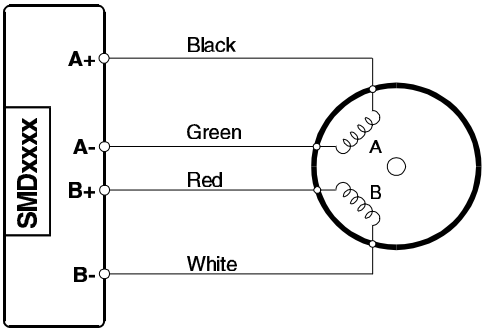
Connection of Zebotronics motor Type: SMxx.x.xx.x



Connection of Wexta motor Type: PH2xx-xxx



Connection of Teco motor Type: 4Hxxxx

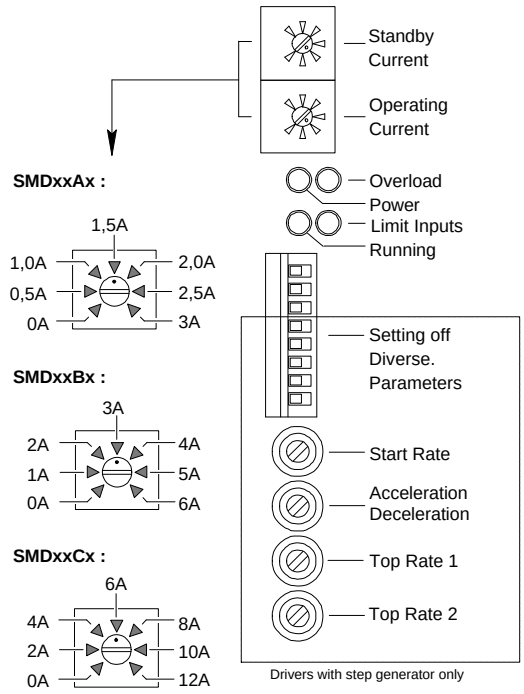


3.5 Overview of Switch Settings

Overview of DIP switch Functions		1 2 3 4 5 6 7 8	
DIP-switch	**Function**	▪	▪
1 see Sect. 1.6	Full Step : 200 steps per motor revolution. Half Step : 400 steps per motor revolution.	Full Step	Half Step
2 see Sect. 1.4	Internal : Switch between current internally. External : Switch between current externally via C.Sel.	Internal current switch	External current switch
3 see Sect. 1.4	Internal : Operating current determined by 2 trimmers. External : Operating current determined by S.Adj. Input	External current value	Internal current value
4 see Sect. 2.1	Internal : Step Pulse generation via internal Step Generator. External : Step Pulses supplied externally via CLK Input.	Internal step pulse	External step pulse
5 see Sect. 2.2	Internal : Top Rate 2 determined by internal trimmer. External : Top Rate 2 controlled by external voltage.	Internal Top Rate 2	External Top Rate 2
6	M0 : See table below and Section 2.1		
7	M1 : See table below and Section 2.1		
8	M2 : See table below and Section 2.1		

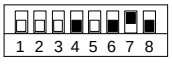
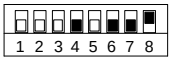
DIP-switches 4 to 8 only on Drivers with integral Step Generator (Types SMDxxx2 and SMDxxx4)

Location and function of settings



The above information is an overview

See individual sections for further details

DIP-Switch :	IN2	IN1	Motor
Mode 1 	0 0 1 1	0 1 0 1	Stopped Reverse Stopped Forward
Mode 2 	0 0 1 1	0 1 0 1	Stopped Forward Reverse Undefined
Mode 3 	0 0 1 1	0 1 0 1	Undefined Reverse Forward Stopped
Mode 4 	0 0 1 1	0 1 0 1	Stopped Forward Stopped Stopped
Mode 5 	0 0 ↓ 1	0 ↑ 0 1	Stopped Forward Stopped Undefined
Mode 6 	0 0 ↓ 1	0 ↑ 0 1	Stopped Forward Stopped Undefined
Modes 7 and 8 are reserved for future use			