

11.2 Step motor controllers (SMCxx)



SMC75



SMC75 mounted in a housing

The compact step motor controller SMC75 is designed for positioning and speed control of stepper motors. SMC75 is a PCB with dimensions 57x57mm and mounted with SMD electronics on both sides.

It is mounted directly in the housing of the JVL QuickStep motors MIS 231, 232 and 234, forming a complete integrated step motor. It may also be used with other types of step motors according to customers requirements. The basic features of the controller are:

- Serial RS485 or 5V serial position controller
- Position controller with graphic programming.
- Option for CANbus, CANopen DS-301/DSP-402 or DeviceNet (under development).
- A dual supply facility is available so that position and parameters are maintained at emergency stop
- Gear mode
- MACmotor protocol so MACmotor and Quickstep motors can be connected on the same RS485 bus
- Command for easy PLC/PC setup and communication
- Power supply 12-48VDC
- Fixed 1600 pulses/rev.
- Built-in μ processor with 8 In/Out that can be configured as inputs, PNP outputs or analogue inputs. 5V serial and RS485 interface for set up and programming.
- MODBUS interface.
- 9.6 to 1Mb communication

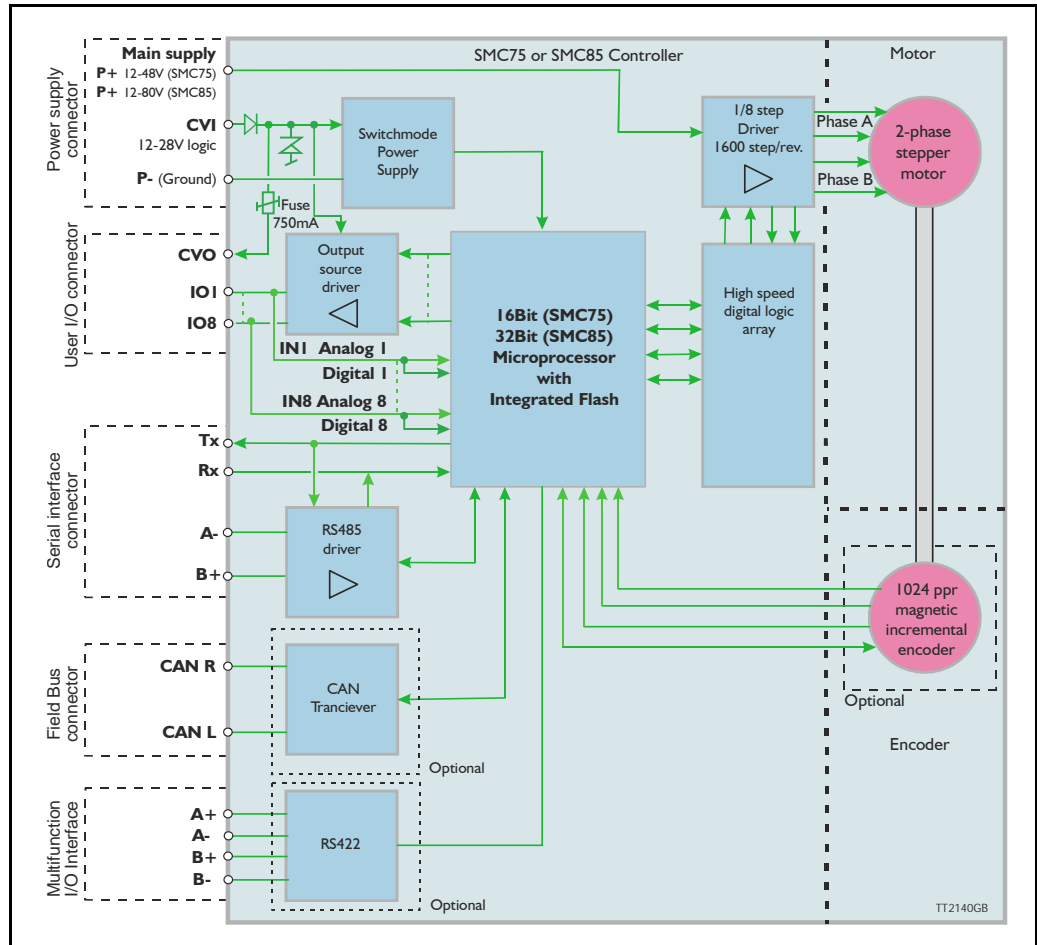
- Driver technology is improved as compared to SMD73 and supply voltage is 12-48VDC (Control voltage 12-28VDC).

When used with the QuickStep motor or mounted on any other step motor the advantages of the controller are:

- De-central intelligence.
- Simple installation. No cables between motor and driver.
- EMC safe. Switching noise remains within motor.
- Compact. Does not take space in cabinet.
- Low-cost alternative to separate step or servo motor and driver.
- Stall detect by means of magnetic encoder with resolution of up to 1024 pulses/rev.
- Interface possibilities to the SMC75 controller:
 - From PC/PLC with serial commands via 5V serial or RS485.
 - Pulse/direction input. Encoder output.
 - CANopen, DeviceNet
 - 8 I/O, 5-28VDC that can be configured as Inputs, Outputs or analogue inputs
 - Future option for Profibus DP, Ethernet, Bluetooth and Zigbee wireless

11.2 Step motor controllers (SMCxx)



11.2.1 Block diagram, Positioning/Speed Control



11.2 Step motor controllers (SMCxx)

Step Motor Controller SMC75 is a mini-step driver with fixed 1600 pulses/rev., which has been designed for driving step motors with phase currents of up to 3 Amp/phase (RMS).

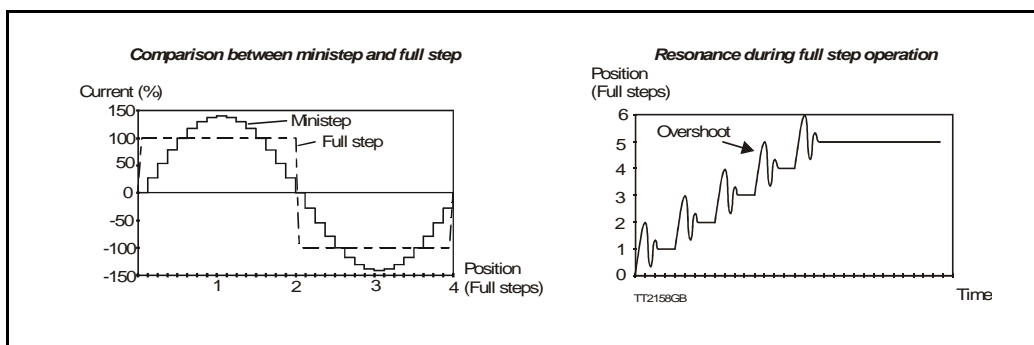
The Controller SMC75 is available in 2 different versions for various applications. It is built into the QuickStep Integrated Step Motors, but for OEM and low-cost applications it can be delivered as a PCB or in its own housing with M12 connectors. For easy mounting and service, the version with M12 connectors is recommended. A version with cable glands can be used for high volume and low cost applications.

	Order no.	PCB	BOX	CANopen	IO	RS485	M12	Cable Glands
	SMC75AI	X			8	1		
	SMC75AIAC	X		X	8	1		
	SMC75AIM3		X		4	2	X	
	SMC75AIM5		X		8	1	X	
	SMC75AIM6		X	X	8	1	X	
	SMC75AIW0		X		8	1		X

Other combinations and features are also possible for OEM use. See “Connector overview for the MIS23x” on page 32. for further information.

The “box” version which is built into a black aluminium casing provides a very robust construction that is insensitive to mechanical vibration and electrical noise.

The advantage of using a ministep driver instead of a conventional full-step or half-step driver is that mechanical resonance problems are significantly minimised. Resonance most often occurs at slow motor speeds and results either in loss of motor torque or the appearance of significant harmonics. The principle of the ministep technique is to drive the motor using a sinusoidal current in the interval between 2 physical full steps. This reduces the step velocity between each step and thus damps any resonance significantly.

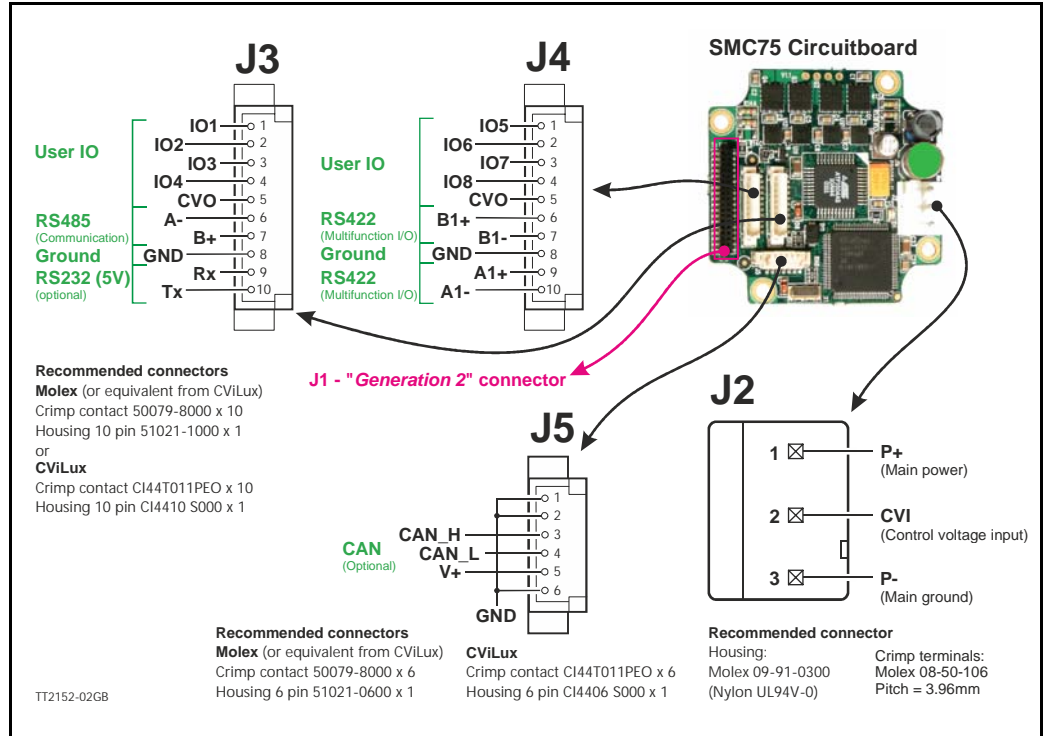


Both 2-phase and 4-phase step motors can be connected to the Controller, which utilises the “Bipolar Chopper” principle of operation, thus giving optimum motor performance.

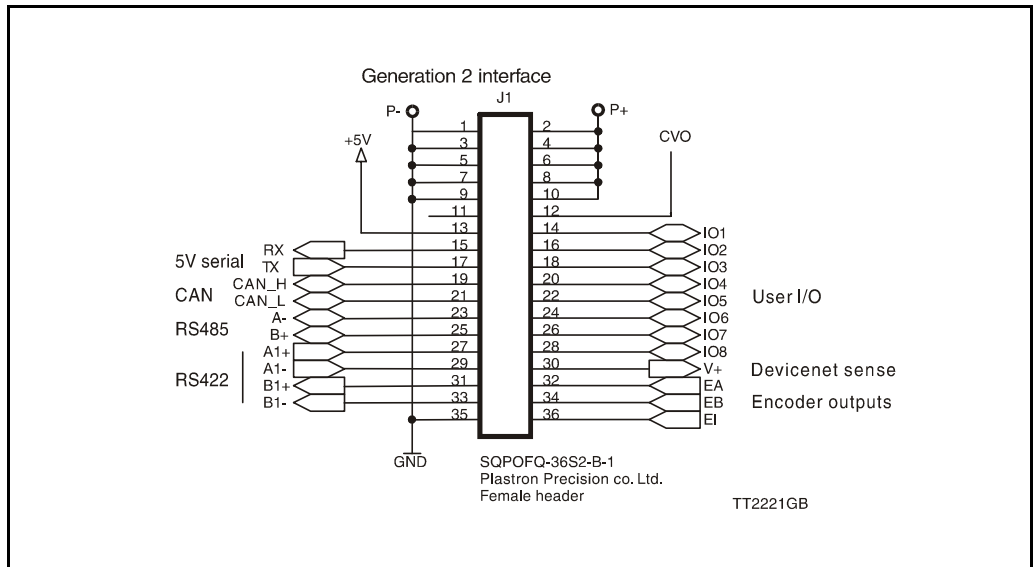
11.2 Step motor controllers (SMCxx)

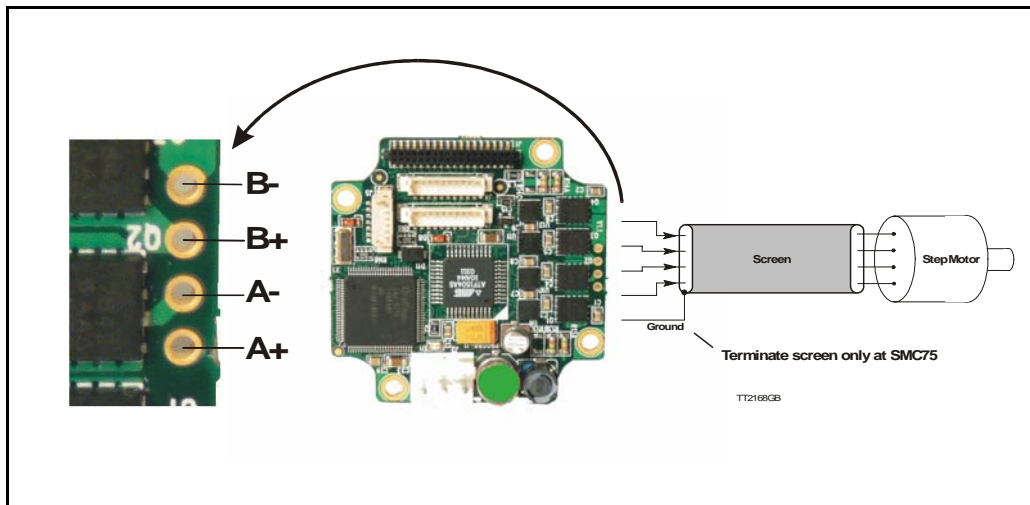
11.2.2 SMC75 Connector overview

The connections to the various connectors of the SMC75 PCB board is shown below. Note that GND and P- are connected together internally.



The figure below shows the generation 2 connector for future or special purposes. Please contact JVL for further information.





11.3.1 Cabling

For SMC75 controllers that supply a phase current in the range 0 to 3 A, it is recommended that 0.5mm² cable (minimum) is used to connect the motor to the controller. (0.75mm² is recommended.)

Motor cable lengths should not exceed 10 metres because of impedance loss. It is possible to use longer cables but motor performance will decrease.

Cables should be securely connected since a poor connection can cause heating and destruction of the connector. Similarly, tinned conductors should be avoided.

Important!

To minimise spurious noise emission from the motor cables and to fulfil CE requirements, shielded cable must be used.

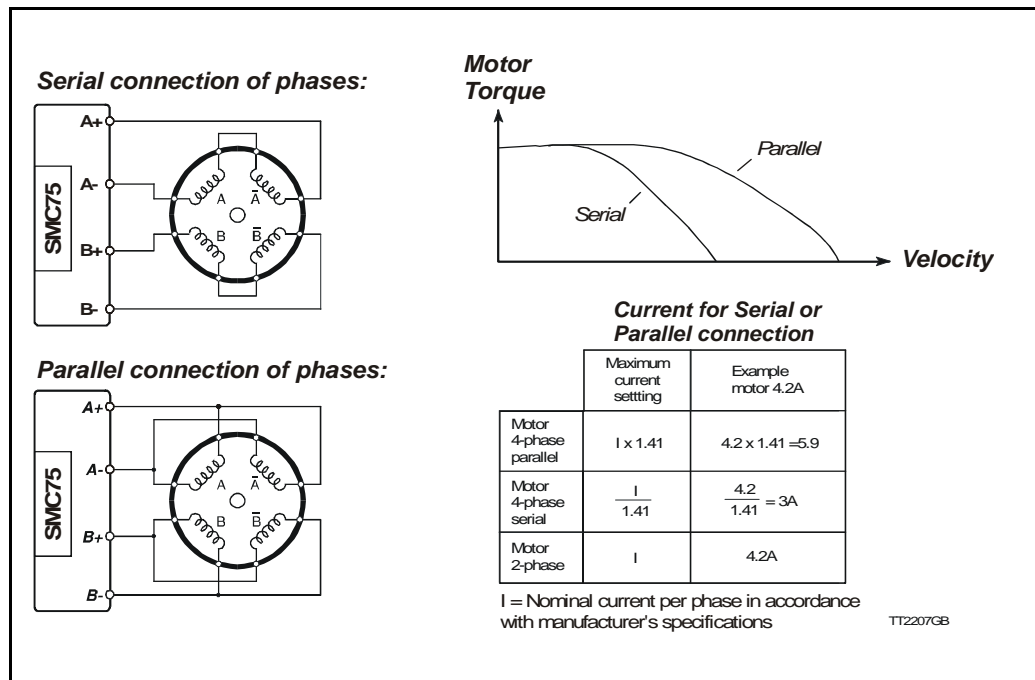
If shielded cable is not used, other electronic equipment in the vicinity may be adversely affected.

The removable connector must never be removed while a voltage is connected as this will significantly reduce the lifetime of the connector. Note also that the connector's lifetime is reduced by repeated connecting/disconnecting since the contact resistance of the pins is increased.

Note that P- is connected to the chassis and functions as the main ground on the Controller.

See also *Motor Connections Section 15.6*, page 303, which describes how various models of motor should be connected to the Controller.

11.3 How to connect the motor



11.3.2 Connection of Step Motor

Various types of step motor are available:

1. 2-phase Bipolar (4 connectors)
2. 4-phase Bipolar/Unipolar (8 connectors)
3. 4-phase Unipolar (6 connectors).

Note that Type 3 motors indicated above (Unipolar motors) produce 40% less torque. This motor type can be used with success but is not recommended if a 4 or 8 wire motor is available instead. This section will not describe the unipolar type further.

2-phase or 4-phase motors can be connected to the Controllers as follows:

2-phase Motors (4 wires).

This type of motor can be directly connected to the Controller's motor terminals. The Controller current adjustment must not exceed the manufacturer's specified rated current for the motor.

4-phase Motors (8 wires).

This type of motor can be connected to the Driver in one of the following two ways:

1. Serial connection of phases.
2. Parallel connection of phases.

Selection of serial or parallel connection of the motor phases is typically determined by the speed requirements of the actual system.

If slow speeds are required (typically less than 1 kHz), 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.

11.3

How to connect the motor

11.3.3 Serial Connection

Using serial connection of the phases, a motor provides the same performance (up to 1 kHz) as parallel connection, but using only approximately half the current. This can influence the selection of Controller model and enables a Controller rated for a lower motor current to be used. See illustration on previous page.

If the phases of a 4-phase step motor are connected in series, the motor's rated phase current should be divided by 1.41. For example, if the rated current is 4.2A, the maximum setting of the Controller phase current must not exceed 3 A when the motor phases are connected in series.

11.3.4 Parallel Connection

With parallel connection of motor phases, a motor will provide better performance at frequencies greater than 1 kHz compared to serially connected phases, but requires approximately twice the current. This can influence the choice of Controller since it is necessary to select a Controller that can supply twice the current used for serial phase connection. See illustration on previous page.

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 2.0A, the maximum setting of the Controller phase current must not exceed 2.83A when the phases are connected in parallel.

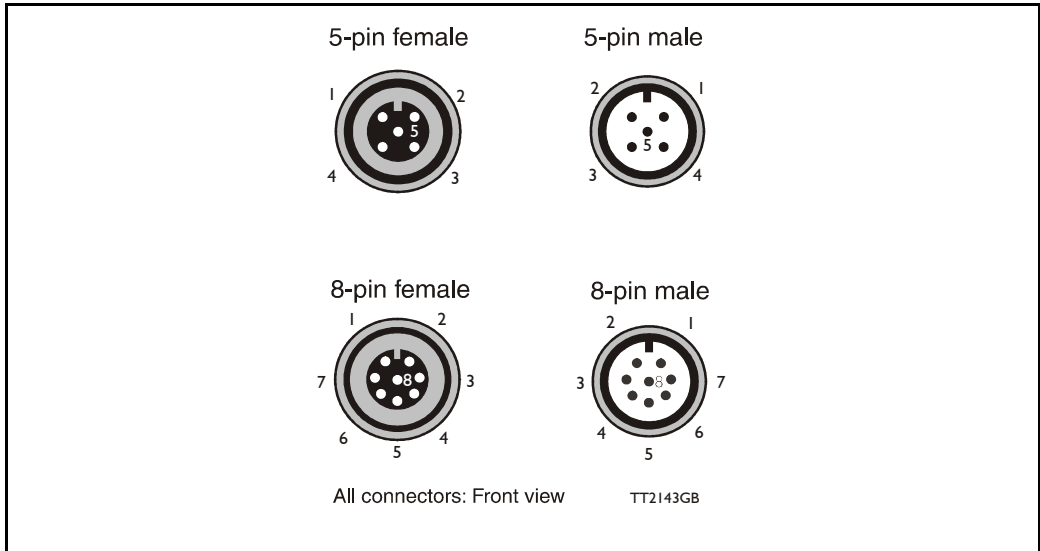
It should be noted that the lower the self-induction of the motor the better, since this influences the torque at high speeds. The torque is proportional to the current supplied to the motor.

The applied voltage is regulated by the Controller so that the phase current is adjusted to the selected value. In practice this means that if a motor with a large self-inductance (e.g. 100mH) is used, the Controller cannot supply the required phase current at high speeds (high rotational frequencies) since the output voltage is limited.

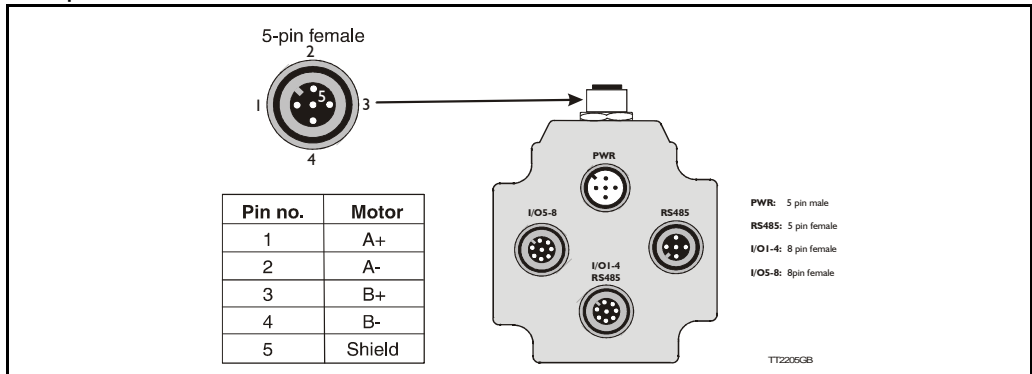
11.4 How to connect in general

11.4.1 MIS23x: M12 connections

M12 connectors



Example of SMC75 controller connections.

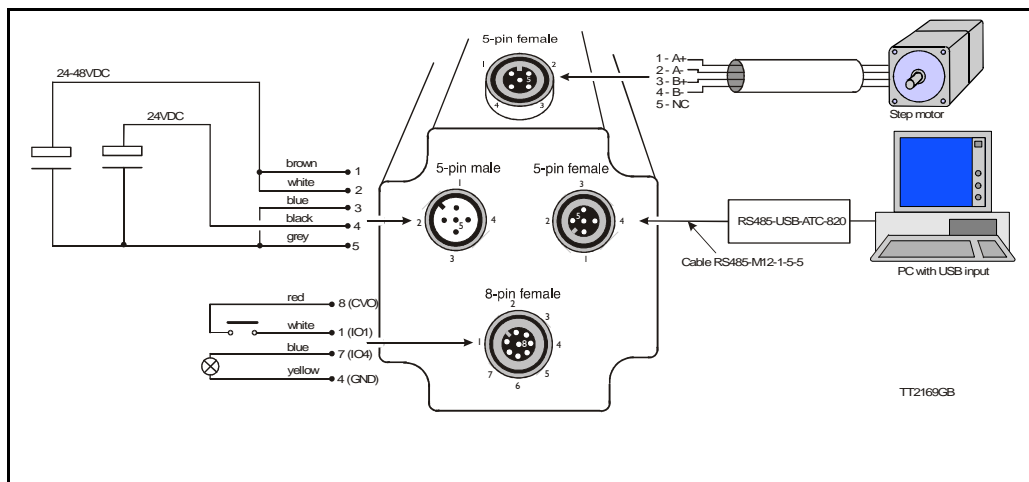


5- pole connector	
Pin no.	Colour
1	Brown
2	White
3	Blue
4	Black
5	Grey

8-pole connector	
Pin no.	Colour
1	White
2	Brown
3	Green
4	Yellow
5	Grey
6	Pink
7	Blue
8	Red

Colour code for standard cables

11.5 Quick Start (SMC75A1MxAA)



11.5.1 Getting started with the SMC75A1MxAA and MacTalk

1. Connect the cables and Power supply as shown above. Use RS485-M12-1-5-5 cable if the PC has an RS485 interface, or use the converter RS485-USB-ATC-820 if the PC has a USB interface. Please note that other models use an 8-pin female connector and therefore use RS485-M12-1-5-8 cable.
2. Switch on the SMC75.
3. Start MacTalk and wait 5 seconds until it automatically is connected to the motor. If “no connection” occurs, check the serial cables and the Mactalk set-up. The Baud rate should be 19200 and the correct com port selected.
4. When a connection has been established, key in values of “running current” and “standby current” under “Driver Parameters”. Remember to press “Enter” after each parameter is keyed in. Actual motor values can be seen to the left of the input field.
5. Set “Startup mode” to select “Position” to enable the motor driver. There should now be current in the motor phases. Depending on the standby current, the motor shaft will be fixed. Some current regulation noise should be heard from the motor.
6. The motor and I/O status can be seen to the left under “Status”.
7. At “Motion Parameter”, key in 1600 counts at “Position”. The motor will now turn one revolution at the speed specified by “Max Velocity”.