OEM Speed control board

102 and 313 speed control board
Installation and operating instructions

Contents

Declarations

Declaration of Incorporation	***When this OEM circuit board is to be installed into machines or is to be assembled with other machines for installations, it must not be put into service until the machinery into which it has been incorporated has been declared in conformity with the provisions of the Low Voltage Directive 2006/95/CE and the EMC Directive 2004/108/EC.***

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1.0 Description

This speed control board has been specifically designed for OEM use, providing a speed control ratio better than 10:1.
It is capable of speed control, remote stop, a choice of drive direction, and
accepting remote speed control signal input. With the addition of extra components to the standard board, options of instant direction reverse, power on LED, AC power supply input, board mounted speed control potentiometer and maximum speed (prime) switch are available.

2.0 Specification

- Suitable for use with Watson-Marlow 102FD/R 12V DC motor and 313FD/D 12V DC motor
- Eurocard format
- 32 way edge connector (mating connector supplied)
- Suitable for pillar mounting
- Suitable for use with 20V to 30V DC power supply or AC mains with an appropriate transformer. Refer to section 6.3 (for 102FD/R and 313FD/D motors).

3.0 Identification

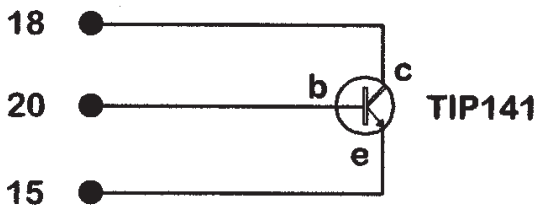
The board is available in two basic versions; part number 019.2021.000 for the 102FD/R motor as a self contained unit, and part number 039.2021.000 for the 313FD/D motor with an external heatsink-mounted transistor. For the 313FD/D version, the additional connections required for the external transistor are covered in the *"313FD/D 12V DC motor - Externally mounted transistor"* section.
This board should be protected by suitable fusing.

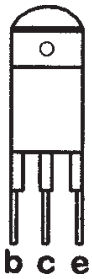
4.0 313FD/D 12V DC motor - Externally mounted transistor

The following external connection has to be made to allow the speed control PCB to be compatible with the 313FD/D drive.

Transistor Q2 is an externally mounted TIP 141. An adequate heatsink must be provided. Suggested area 1000cm^2 (130 sq in) in free air.

Transistor detail:
Watson-Marlow part number ST0019
RS part number 294-839
Heatsink O.65°C/W
RS part number 403-099





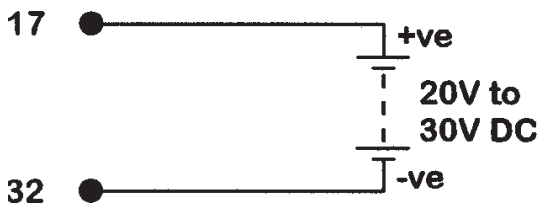
5.0 External component connections

The connections described in sections 5.1, 5.2 and 5.3 are required for all applications. Those described in 5.4 are optional. None of these require any additional board mounted components and all are common for the 102FD/R and 313FD/D versions.

5.1 Power supply

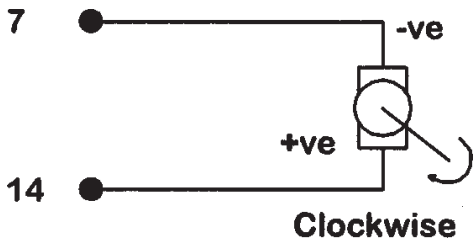
Terminals 17(+ve) and 32(-ve), 20V to 30V DC from either battery or a stabilised DC power supply.
For reverse polarity protection add D5 and use terminals 16(+ve) and 32(-ve).

Rating: 102FD/R = 0.5A, 313FD/D = 2.0A



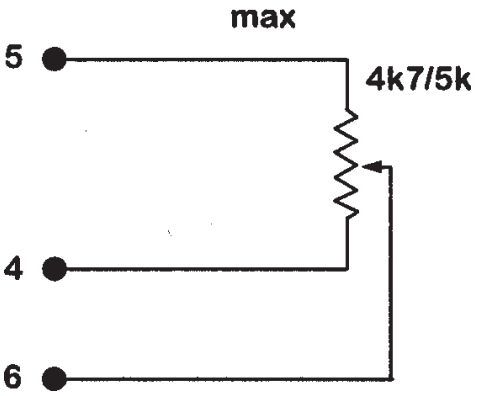
5.2 Motor

Standard non-reversing connections. Anticlockwise rotation may be achieved by reversing the motor connections.



5.3 Speed control

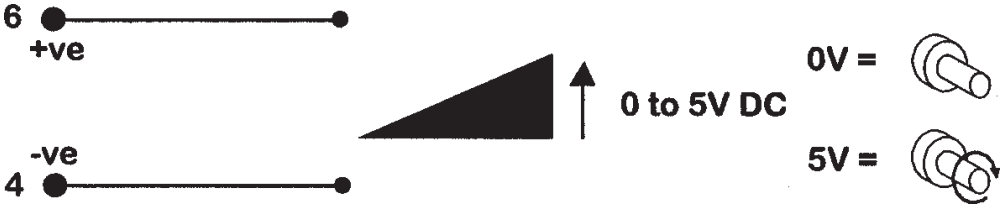
Potentiometer



Note: Options available for
-(1) Board mounted potentiometer
-(2) Molex plug and socket for remote potentiometer.
1W rated
Watson-Marlow part number RV 0087
RS partnumber 162-827

Control signal input

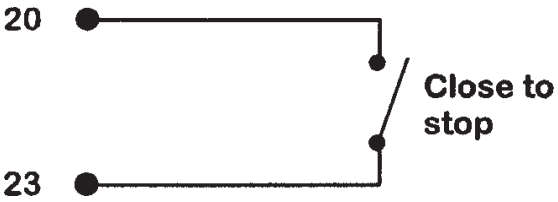
For control by a 0V to 5V analogue signal in place of the speed control potentiometer (wired to terminals 4,5,6). Input impedance of board is approximately 100kW.



Note: The speed control potentiometer wired to terminals 4,5,6 must not be connected when a control signal is used.

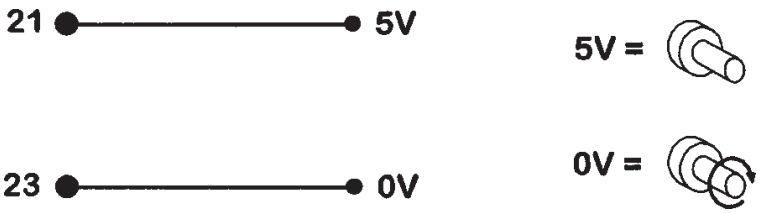
5.4 Remote stop

Manual



Switch contact rating – negligible

TTL and CMOS compatible



Do not apply inputs in excess of 5V to stop rotation.

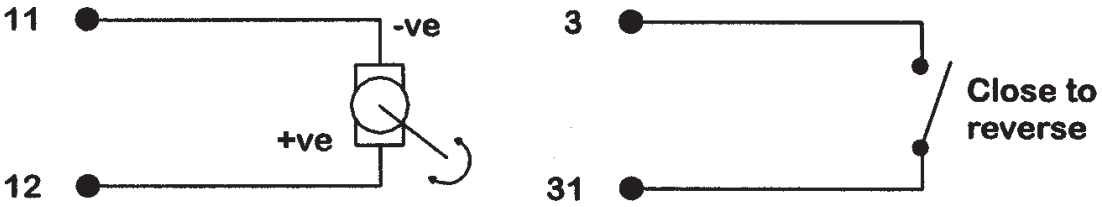
6.0 Options

The following connections require additional board mounted components. These may be obtained from Watson-Marlow and part numbers are given. In addition an RS Component part number is given in some cases as an alternative source of supply. Where part numbers are not stated but signified with ****** please contact Watson-Marlow Technical Support for further information

6.1 Direction reverse relay

With the addition to the board of the following components, the motor may be connected with automatic reverse capability. (Reverse motor connections to terminals 7 & 14).

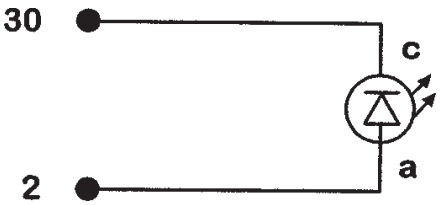
Component	Reference	Type	Watson-Marlow part number	RS part number	
Relay	RL1	12V DC coil	******	376-149	
Diode	D3	IN4005	SD0020	261-182	
Resistor	R13	100kΩ	RC0142	148-972	
Transistor	Q3	TIPP116	******	638-627	
Resistor	R18	180Ω 1/2W	RC0156	132-315	* 20-25V DC supply
		270Ω 1/2W	RC0103	132-359	* 25-30V DC supply and AC supply (see 6.3 AC supply input)



Switch contact rating - negligible
Note: With the switch open, motor connection pin 11 is +ve.

6.2 “Poweron” LED

With the addition to the board of a resistor (R14), a “power on” LED may be connected.



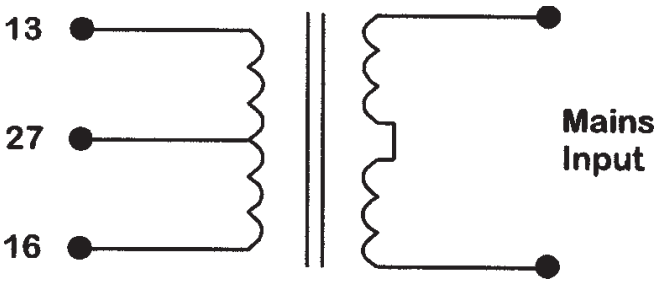
LED
Watson-Marlow part number SD 0035
RS part number 590-474

Note: R14 to be chosen to suit supply voltage and LED type.
Suggested value for type above at 20-25V 1k , ½ W
Watson-Marlow part number RC 0118
RS part number 132-494
Suggested value for type above at 25-30V 1k5, ½ W
Watson-Marlow part number RC 0102
RS part number 132-539

6.3 AC supply unit

For 102FD/R and 313FD/D motors

With the addition to the board of diodes (D4 & D5) and a capacitor (C5), a transformer having a centre tapped secondary winding may be used to supply the speed control circuitry.



Secondary 15-0-15V

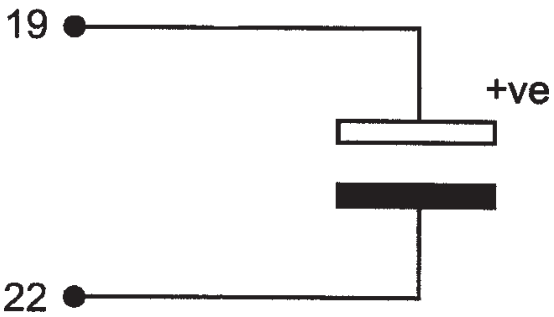
Rating 102FD/R = 12VA
Watson-Marlow part number TF 0008
RS part number 207-655
Rating: 313FD/D = 100VA
Watson-Marlow part number ******
RS part number 207-302

For 102FD/R motor only

Add capacitor C5 to the board: 1000µF, 35V
Watson-Marlow part number: CE 0159
RS part number: 844-068

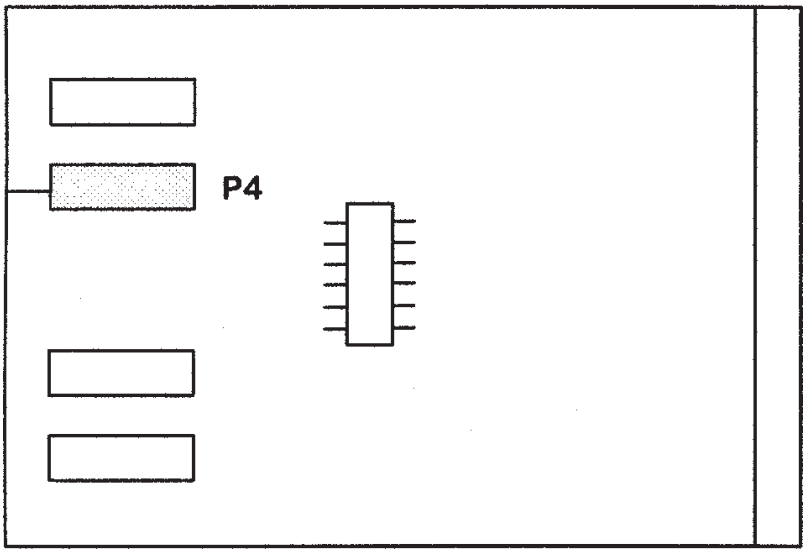
For 313FD/D motor only

Add capacitor C5 to the board: 4700µF, 35V, 10mm pitch, radial.
Watson-Marlow part number: ******
RS part number: 118-274



6.4 Board mounted speed control potentiometer

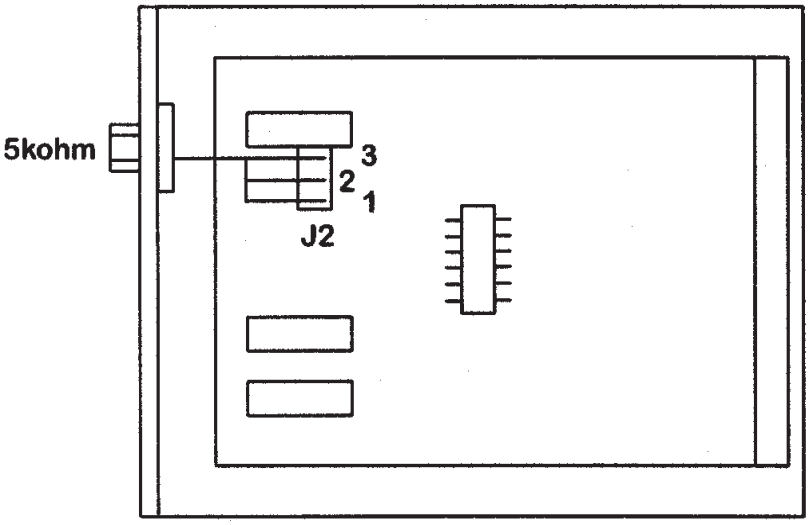
To replace speed control potentiometer (wired to terminals 4,5,6) if “on board” control is required.
Suggested potentiometer: 5k
Watson-Marlow part number: RV 0054
RS part number: 162-221

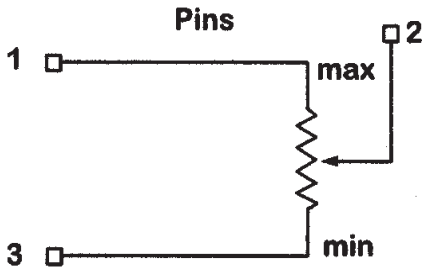


If an on board potentiometer is not being used please refer to Section 6.6, Maximum speed (for priming) switch. Enable the on-board potentiometer by adding link LK1 and resistor R19 in positions marked on the board.
R19-100k
Watson-Marlow part number RC 0142
RS part number 148-972

6.5 Front mounted speed control potentiometer

To replace the speed control potentiometer (terminals 4,5,6) if “front of rack” control is required.





Watson-Marlow part numbers:
Molex Housing SL 0052
Molex Header SL 0024
Molex Terminal SL 0012
Potentiometer RV 0020

RS part numbers:
Molex Housing 467-605
Molex Header 467-554
Molex Terminal 467-598
Potentiometer 4k7/5k: 162-827

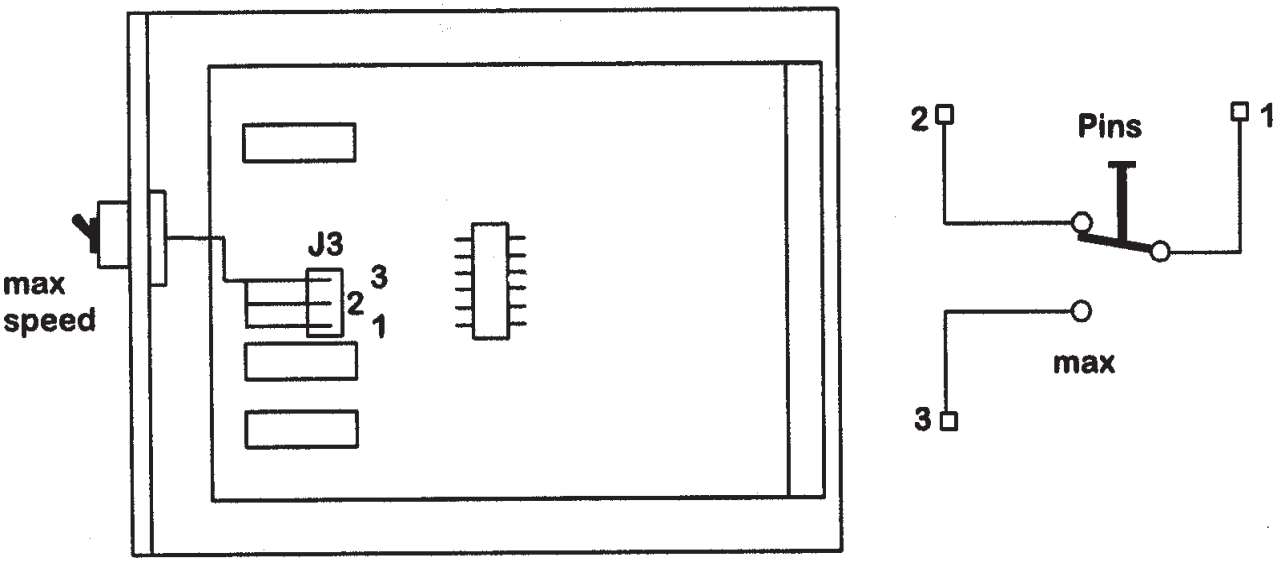
If a Max switch is not being used (see section 6.6), enable potentiometer by adding link LK1 and resistor R19 in positions marked on the board.
R19 - 100k

Watson-Marlow part number RC 0142
RS part number 148-972

Note: If the board mounted (6.4) or front mounted (6.5) with molex connector speed control potentiometers are selected, the speed control potentiometer wired to terminals 4,5,6 must be disconnected.

6.6 Maximum speed (for priming) switch

With the addition of an external non-latching switch wired to connector J3, a maximum speed input is available for ease of priming. Before adding connector J3, ensure that the “switch by-pass link” LK1 between connectors J2,2 and J3,1 is not in place.

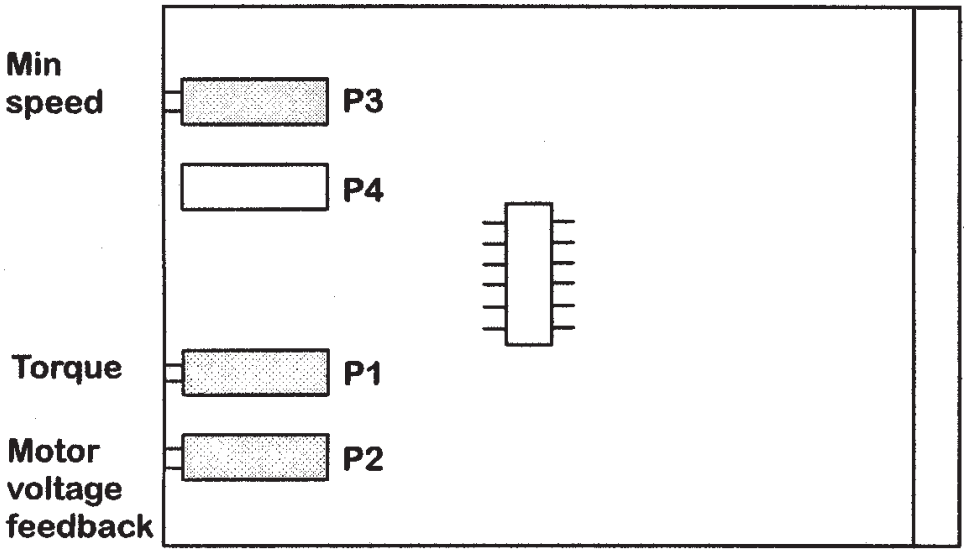


Watson-Marlow part numbers:
Molex Housing SL 0052
Molex Header SL 0024
Molex Terminal SL 0012

RS part numbers:
Molex Housing 467-605
Molex Header 467-554
Molex Terminal 467-598

7.0 Calibration

7.1 Location of preset potentiometers



7.2 Procedure

To calibrate the maximum and minimum speeds, the following procedure should be followed:

Top speed

(This adjustment should be carried out with the drive under the duty load)
Set the “Speed control” potentiometer to maximum or the “Control Signal” input to 5V DC. Adjust the “motor voltage feedback” (P2) potentiometer to give the required maximum output shaft speed.
Note: Do not exceed 110rpm for the 100rpm motor, 70rpm for the 65rpm motor, 55rpm for the 50rpm motor, 11 rpm for the 10rpm motor, 5rpm for the 4rpm motor.

Circuit gain

Set the “Speed Control” potentiometer or the “Control Signal” input to give approximately 10% of the maximum speed setting. Adjust the “Torque Preset” potentiometer (P1) until the output shaft speed remains constant when the normal load is applied.
Note: The motor will hunt if too much torque is set.

Minimum speed

Set the “Speed Control” potentiometer or the “Control Signal” input to the minimum required setting. Adjust the “Minimum Speed Preset” (P3) potentiometer until the output shaft stops (or rotates at the desired minimum speed).

Note: Re-check the sequence as interaction may occur between adjustments.

8.0 Components

Reference	Watson-Marlow part number	Description	RS part number
C5 (102)	CE0159	1000mF, 35V	844-068
C5 (313)	CE0155	4700mF, 63V	105-329
J1	US0051	32-way connector	467-453
J2	SL0052	Molex housing	467-605
	SL0024	Molex header	467-554
	SL0012	Molex terminal	467-598
J3	SL0052	Molex housing	467-605
	SL0024	Molex header	467-554
	SL0012	Molex terminal	467-598
D3	SD0020	IN4005	261-182
D4 (102)	SD0020	IN4005	261-182
D4 (313)	******	P600D	183-4450
D5 (102)	SD0020	IN4005	261-182
D5 (313)	******	P600D	183-4450
P4	RV0054	Preset	162-221
Q2 (313)	ST0019	TIP141	294-839
Q3	******	TIPP116	638-627
R13	RC0142	100kΩ	148-972
R14 (20-25V)	RC0042	1k 1/2W	148-506
R14 (25-30V)	RC0094	1k5 1/2W	148-540
R18 (20-25V)	RC0156	180Ω	132-315
R18 (25-30V)	RC0103	270Ω	132-359
R19	RC0142	100kΩ	149-972
RL1	******	Relay 12V DC	376-149
	TF0008	Transformer 12VA	207-655
	******	Transformer 100VA	207-302
	SD0035	LED	590-474
	RV0020	Potentiometer 4k7/5k	162-827