

Mitsubishi D700-SC Frequency Inverter Easy Start Guide



The Mitsubishi D700-SC Frequency Inverter range is available to order from inverterdrive.com

This guide is intended to complement the user manual provided by the manufacturer. It is provided as a basic introduction to the product for Inverter Drive Supermarket customers. It should not be used as a replacement for the manual issued by the manufacturer.



This product is not a safety device. All safety considerations including but not limited to Emergency Stop provision should be assessed separately and are outside the scope of this guide.

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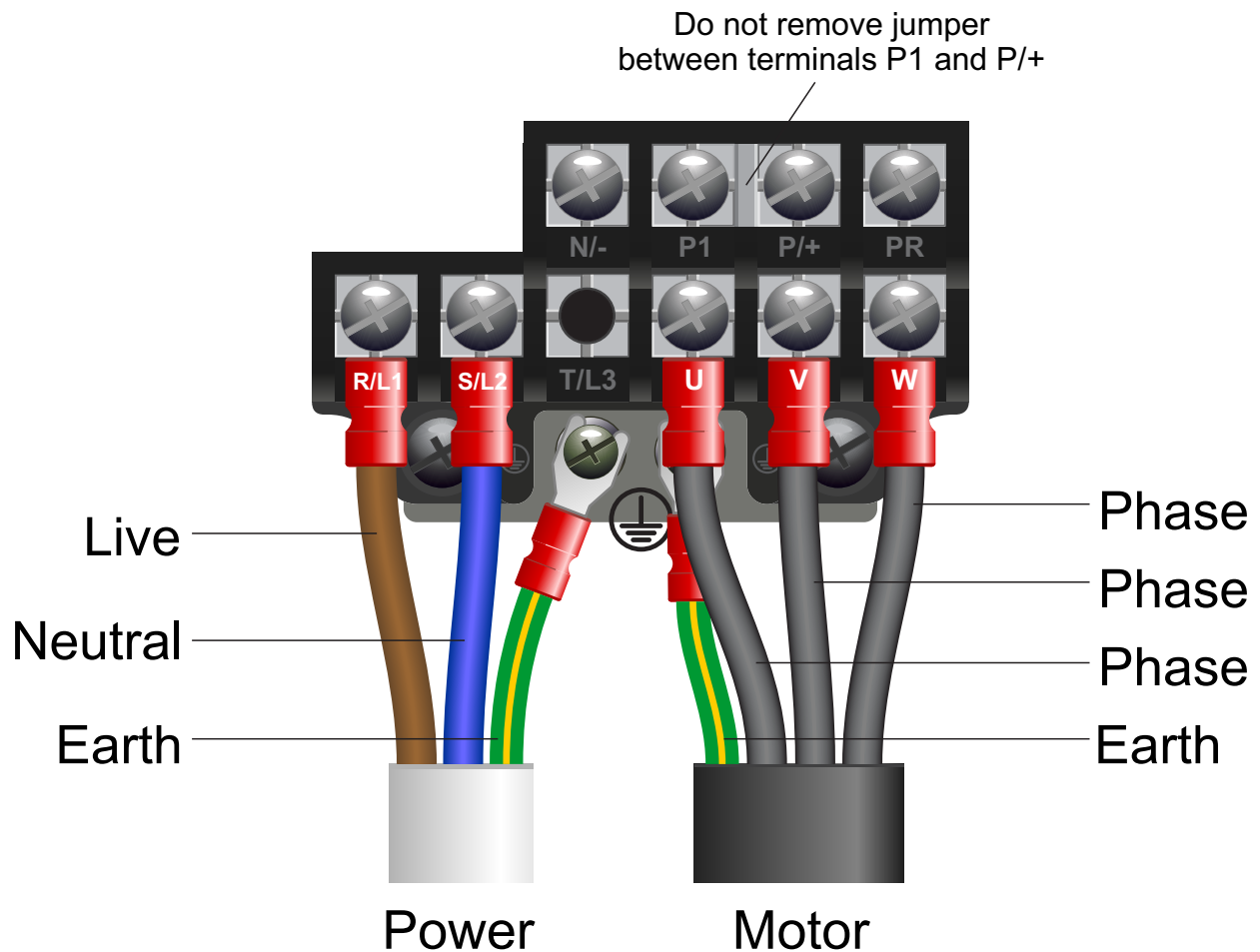
Mitsubishi D700-SC Series Inverter

INVERTER DRIVE[®]
SUPERMARKET

1. Power and Motor Connections (Single Phase)



Before commencing, confirm that the Inverter and all cables are completely isolated from the power supply, have been isolated for at least 5 minutes and that the motor is not turning.



Notes:

The illustration above is based on the smaller 230V Single Phase frame size model (to 0.75kW). The terminal layout for larger 1.5kW and 2.2kW frame sizes are similar.

The order of the three output phases determines the direction the motor turns.

Important:

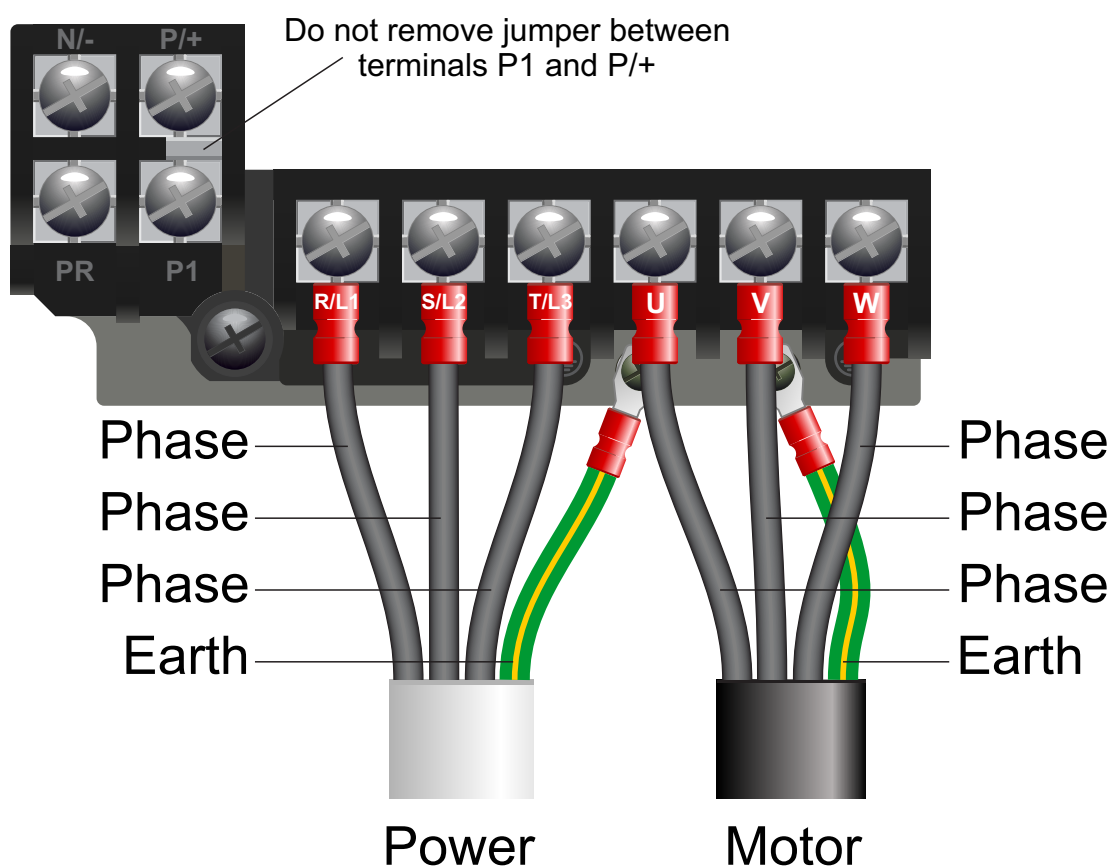
Use screened cable between the Inverter and Motor. To minimise electromagnetic interference, ensure the cable screen is grounded.

The supply must match the Inverter specification.

2. Power and Motor Connections (Three Phase)



Before commencing, confirm that the Inverter and all cables are completely isolated from the power supply, have been isolated for at least 5 minutes and that the motor is not turning.



Notes:

The illustration above is based on the smaller 400V Three Phase frame size model (to 3.7kW). The terminal layout for larger 5.5kW and 7.5kW frame sizes is similar. The order of the three motor phases determines the direction the motor turns. The order of the three power phases is unimportant.

Important:

Use screened cable between the Inverter and Motor. To minimise electromagnetic interference, ensure the cable screen is grounded.

The supply must match the Inverter specification.

3. Motor Connections - Star and Delta

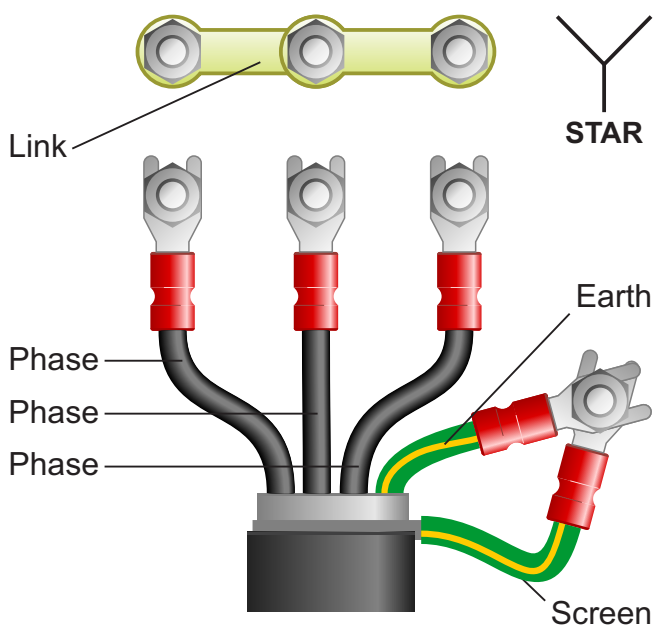
Dual voltage induction motors typically include terminal boxes with six points. The points can be connected together with links in one of two ways to suit one of the two rated voltages.

The two ways of connecting the links are shown below. These are known as “Star” (the higher voltage) or “Delta” (the lower voltage).

The selection of Star or Delta is not optional and must match the supply voltage.

Dual voltage motor nameplates include symbols to represent voltage and full load current in each configuration.

Delta is represented by a triangle and star by a Y (Wye).



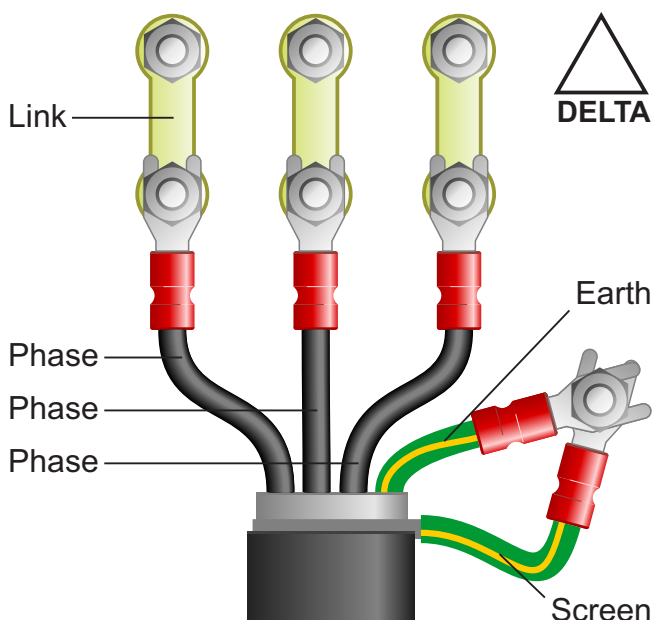
3.1 Motor connected in STAR (or Wye):

For safety purposes, Star (shown opposite) is the default configuration for new motors and is sometimes known as “two at one side”.

Only two links are required for Star. Double-up the links if changing from Delta to allow the motor to be changed to back in future.

The order of the three phases determines the direction the motor turns.

Note that the cable screen and earth are connected together at the earth terminal.



3.2 Motor connected in DELTA:

The link configuration is shown in the illustration opposite and is sometimes referred to as “three-a-breast”.

The order of the three phases determines the direction the motor turns.

Note that the cable screen and earth are connected together at the earth terminal.

4. Parameters - overview

The Inverter contains a number of settings which can be changed to tailor it for use in a wide range of applications. These settings are known as parameters.

Parameters are typically referred to by code or number (eg. Pr. 9 = Rated Motor Current) with a description available in the manual.

The parameters contain critical information essential to the correct operation of the Inverter. Therefore, they should at least be checked by the user before the Inverter is operated for the first time.

The parameters listed in section 5 are intended to provide a starting point to allow for basic operation of the D700 SC Inverter.

5. Parameters to set before use

Set the following parameters to allow the D700 SC to control a motor with Run, Stop and Speed Control from the keypad.

If any of the parameters have been changed previously, follow the procedure in section 14 to reset the Inverter to Factory Defaults.

See section 6 to learn how to set a parameter value.

5.1 Parameters to check and values to set

Parameter	Description	How to set
Pr. 1	Maximum Frequency (Hz)	Maximum frequency of the <i>Inverter</i> . Default is 120. Set to 50 for most applications.
Pr. 2	Minimum Frequency (Hz)	Minimum frequency of the <i>Inverter</i> . Default is 0. Set to 5 for most applications.
Pr. 3	Base Frequency (Hz)	Inverter output frequency at input voltage. Normally 50 Hz.
Pr. 7	Acceleration time (seconds)	Default is 5 or 10 . Increase or decrease if faster or slower acceleration is required.
Pr. 8	Deceleration time (seconds)	Default is 5 or 10 . Increase or decrease if faster or slower deceleration is required.
Pr. 9	Electronic thermal O/L relay (A)	Rated current of the <i>Motor</i> . Set to match motor nameplate - eg. 3.34 Amps
Pr. 13	Starting frequency (Hz)	Frequency at which the Inverter will start the motor. Default is 0.5 . Change if required.
Pr. 14	Load pattern selection	Default is 0 (most applications). Set to 1 for fan or centrifugal pump applications.
Pr. 72	PWM Frequency selection (kHz)	Set to 15 for motor cable lengths to 50m or 8 for 50-100m or 2 for 100m+.
Pr. 79	Operation mode selection	Set to 0 to allow control to be switched between Inverter Keypad (PU) and Terminals (EXT).
Pr. 83	Rated motor voltage	Rated voltage of the <i>Motor</i> . Set to match motor nameplate - eg. 230 Volts
Pr. 84	Rated motor frequency (Hz)	Rated frequency of the <i>Motor</i> . Set to match motor nameplate - eg. 50 Hz
Pr. 160	Extended function display selection	Set to 0 to display both simple and extended parameters.

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6. How to set a Parameter value



6.1 Select "PU" operation mode.

With the motor stopped, press the "PU/EXT" key repeatedly until the "PU" indicator is illuminated and "0.00" is displayed.

Note: *If the operation mode is not changed to PU the Inverter will not allow parameter values to be changed and return an Er. 4 message.*



6.2 Change mode to "Parameter setting".

Press the "MODE" key repeatedly until the "PRM" indicator is illuminated. The display will show "P. 0" as shown opposite (or the parameter which was last selected).



6.3 Select the required parameter.

Use the dial to scroll through the parameters until the desired parameter is shown. In this example, we will select parameter 1 (as shown in the illustration opposite).

Press the "Set" key to select the parameter.



6.4 Change the parameter value and set.

The display will show the current parameter value. Use the dial to increase or decrease the value as required. In this case we will reduce the value from 120.0 to 50.00.

Press the "SET" key to save the new value. The display will flash between parameter and value.

Press the "SET" key again to confirm.

Press "SET" one more time to return to the parameter list. The next parameter in the list is shown.

7. How to operate the Inverter from the keypad



7.1 Select “MON” and “PU” modes.

With the motor stopped, press the “PU/EXT” key repeatedly to cycle through operation modes until the “PU” indicator is illuminated and “0.00” is displayed. Then, press the “MODE” key repeatedly to cycle through modes until “MON” is illuminated. Finally, ensure the display is set to “Hz”. If it is set to “A” (Amps), use the “SET” key to change to “Hz”.



7.2 Set the desired speed.

Rotate the dial to set the desired speed. In this example, we have set this to 25.00Hz which is half speed for a standard 50Hz motor.

Press “SET” to save. The display will alternate between “F” and your selection for 3 seconds before returning to 0.00 (the current speed). When saving, ensure you don’t accidentally set the display to “A”. If you do, use the “SET” key to change back to “Hz”.



7.3 Press the green “RUN” key to start the motor.

The green key will start the motor. The time taken for the motor to accelerate to the desired speed (in seconds) is proportional to parameter Pr. 7. The “RUN” indicator will illuminate to indicate that the motor is running.

To change the speed whilst the motor is running, rotate the dial to select the new speed and press “SET” to confirm. The motor will accelerate or decelerate to the new speed.



7.4 Press the red “Stop” key to stop the motor.

The red key will stop the motor. The time taken (in seconds) to stop the motor is proportional to parameter Pr. 8.

Note: if you would prefer to continually adjust the speed using the dial (rather than confirming with set each time) change parameter Pr. 161 to 1.

8. How to enable Sensorless Vector mode

The standard motor control mode of the D700 SC Inverter is VxF. This simple mode controls motor speed by varying Volts and Frequency in a specific ratio to maintain output torque.

The D700 SC can also operate in Sensorless Vector mode. This can improve motor performance without requiring a separate feedback device. Sensorless Vector mode operates in the same way as VxF but performs a number of calculations to improve low speed torque.

These calculations require an “auto tuning” run during which the Inverter operates for approx. 10s to gather the necessary data. The shaft does not turn.

To enable sensorless vector control first set the parameter values specified in 8.1 and then perform the auto tuning run described in 8.2 and 8.3.

The motor shaft does not turn during auto tuning.

8.1 Parameters to change to enable sensorless vector control

Parameter	Description	How to set
Pr. 71	Applied motor	Default is 0. Set to 3 for “Standard motor”.
Pr. 80	Motor capacity (kW)	Default is 9999 (not set). Set to the motor rated power. eg. 0.75 kW
Pr. 82	Motor excitation current	Default is 9999 (not set). Set to approx 30% of motor full load current.
Pr. 96	Auto tuning setting/status	Default is 0. Set to 11 for general purpose magnetic flux vector control.
Pr. 90	Motor constant (R1)	Default is 9999 (not set). Do not change - this value will be set automatically by auto tuning.



8.2 Enable monitoring and start auto tuning.

Once the parameters in 8.1 have been set, check that the operation mode is set to “PU”. If not, use the “PU/EXT” key to cycle through operation modes.

The display will show 11 to indicate that the Inverter is ready for tuning. Press “RUN” to begin tuning.

The display will show 12 whilst tuning is in progress.

Note: If “Er. 4” is displayed ensure that the operation mode is set to PU (see above) then press RUN again.



8.3 Auto tuning is complete.

The tuning process will take approx. 10 seconds during which excitation noise will be heard from the motor.

When the process is complete, the display will show 13 to indicate normal completion and the “RUN” indicator will flash. Press “STOP” to complete.

If the display shows 9 auto tuning completed with errors.

9. How to connect and configure a Potentiometer for remote speed control

If speed control via the integrated dial is unsuitable for the application, a remote Potentiometer can be used instead.

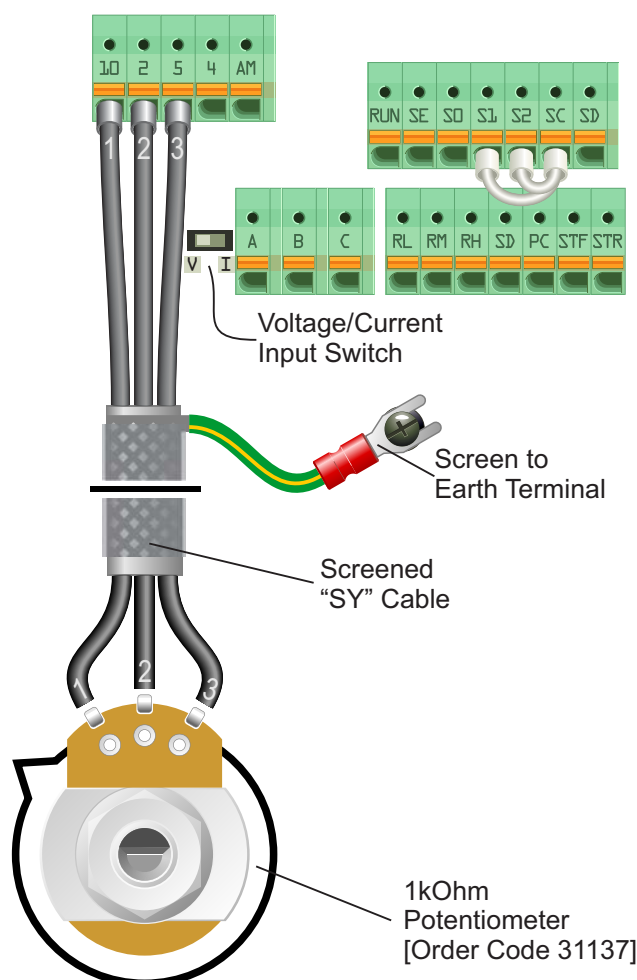
This provides the benefit of allowing motor speed to be controlled from a more convenient location such as a cabinet door (if the D700 SC is cabinet-mounted) or on the machine itself.

A Potentiometer of **1kOhm** rating should be used.

The number of turns depends on the application. A single turn Potentiometer is available from The Inverter Drive Supermarket at InverterDrive.com.

9.1 Parameters to change for remote Potentiometer speed control

Parameter	Description	How to set
Pr. 59	Remote setting function	Default is 0. Set to 1 to enable frequency setpoint via Analogue input terminal 2.
Pr. 73	Analogue input selection	Set to 1 for 5V (default).
Pr. 79	External operation mode	Set to 4 to use the Potentiometer as the speed reference with Start/Stop via Inverter keypad. Set to 0 to use the Potentiometer as the speed reference with Start/Stop via external controls.



9.2 Connecting the Potentiometer

First, ensure the Voltage/Current Input switch is set to "V" (Voltage).

A wiring diagram is shown in the illustration opposite. The most important connection at the Potentiometer end is the centre terminal or "wiper". The wiper will output a variable voltage between 0 and 5 volts and should be connected to the "2" terminal on the Inverter. It is this voltage which provides the speed signal with 0V being slowest and 5V fastest.

The default output frequency at 0V is the minimum frequency of the Inverter. To change this, edit Parameter 2. The default output frequency at 5V is 50Hz. To change this, edit Parameter 125.

If the rotation of the Potentiometer is the opposite to that required (ie. turn anti-clockwise to increase speed instead of clockwise) reverse connections 10 and 5. Use shielded SY cable between Potentiometer and Inverter and ensure that the cable screen is connected to the Inverter earth terminal.

10. How to connect and configure a Run Forward or Run Reverse switch

The procedure described in section 7 enables Run/Stop operation via the red and green buttons on the Inverter keypad.

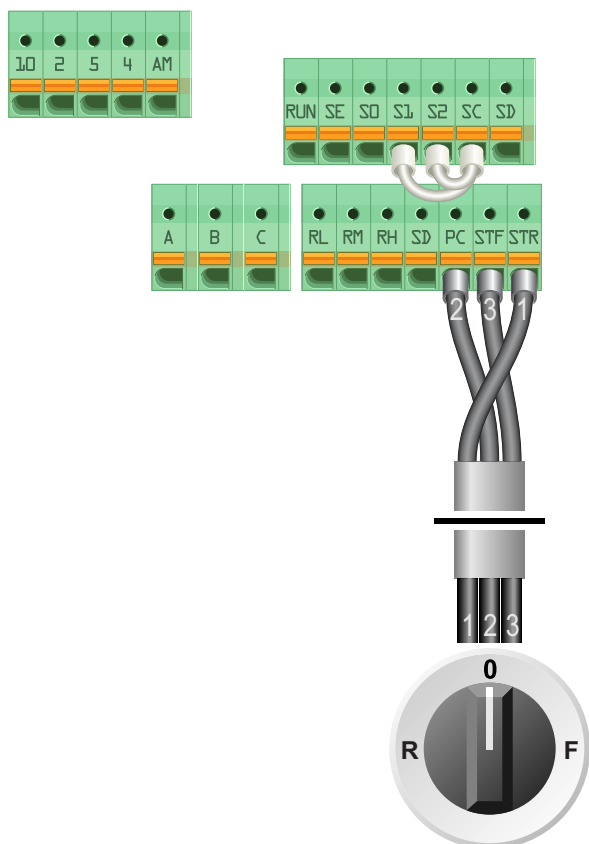
If this is unsuitable for the application, a remote switch can be used instead.

This section explains how to enable 2-wire control with Run Forward / Stop / Run Reverse commands via a single selector switch.

The Inverter must be in “EXT” control mode to operate from the I/O terminals. Press PU/EXT to select.

10.1 Parameters to change for remote Run/Stop

Parameter	Description	How to set
Pr. 2	Minimum Speed	Set to 5.00 to run the motor at 5Hz if no other speed reference has been defined.
Pr. 178	STF terminal function selection	Set to 60 for forward rotation selection. This is the factory default.
Pr. 179	STR terminal function selection	Set to 61 for reverse rotation selection. This is the factory default.
Pr. 250	Stop Selection	Set to 9999 for Run Forward, Run Reverse. This is the factory default.



Switch, 3 Position
Normally Open
“Run Forward / Stop / Run Reverse”

10.2 Connecting the Switch

A wiring diagram is shown in the illustration opposite.

The PC terminal is a common connection for terminals RL, RM, RH, STF and STR when the jumpers are set in “Source” (the default). If the jumpers have been changed to “Sink”, use SD as the common instead.

A suitable 3 position NO (Normally Open) switch should be installed between terminals PC, STF and STR. The centre position should remain open circuit.

When a connection is made between terminals PC and STF, the motor will run forward. When terminals PC and STR are connected, the motor will run in reverse.

If terminals STF and STR are connected to PC at the same time the motor will stop.

The Inverter must be in external control mode to operate in 3-wire control. Check that the “EXT” indicator is illuminated to confirm. The PU/EXT key can be used to change the mode if required.

11. How to connect and configure a Run/Stop switch with Forward/Reverse selection

The procedure described in section 7 enables Run/Stop operation via the red and green buttons on the Inverter keypad.

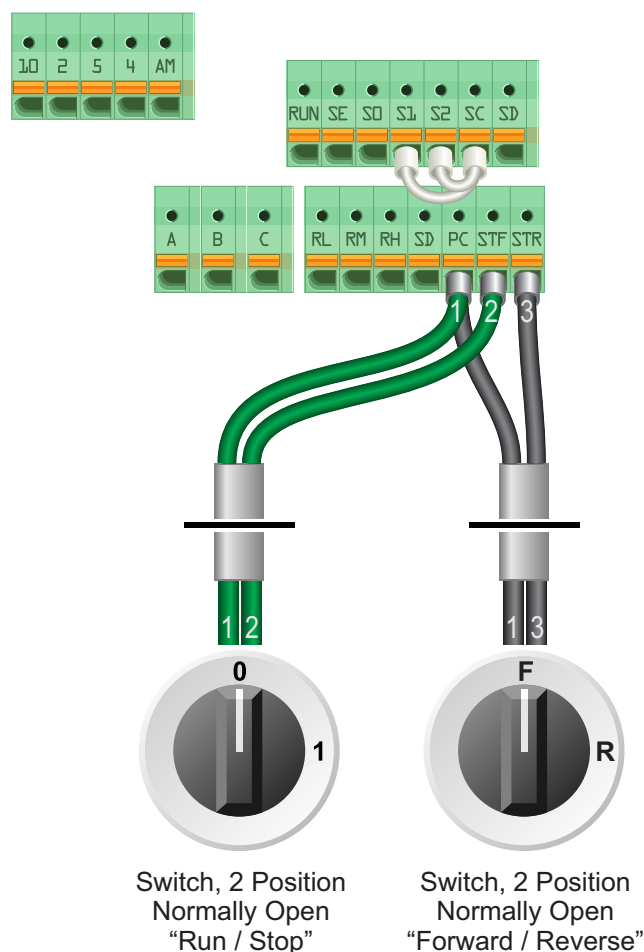
If this is unsuitable for the application, remote switches can be used instead.

This section explains how to enable 2-wire control with Run/Stop and Forward/Reverse commands via separate selector switches.

The Inverter must be in “EXT” control mode to operate from the I/O terminals. Press PU/EXT to select.

11.1 Parameters to change for remote Run/Stop

Parameter	Description	How to set
Pr. 2	Minimum Speed	Set to 5.00 to run the motor at 5Hz if no other speed reference has been defined.
Pr. 178	STF terminal function selection	Set to 60 for forward rotation selection. This is the factory default.
Pr. 179	STR terminal function selection	Set to 61 for reverse rotation selection. This is the factory default.
Pr. 250	Stop Selection	Default is 9999. Set to 8888 for Run with Forward/Reverse selection.



11.2 Connecting the Switch

A wiring diagram is shown in the illustration opposite.

The PC terminal is a common connection for terminals RL, RM, RH, STF and STR when the jumpers are set in “Source” (the default). If the jumpers have been changed to “Sink”, use SD as the common instead.

Two suitable 2 position NO (Normally Open) switches should be installed: One between terminals PC and STF (Run/Stop) and the other between terminals PC and STR (Forward/Reverse).

Note that the Forward/Reverse switch only selects the direction of rotation - it will not start or stop the motor. The direction can be set either before the motor is started or whilst it is running.

If the application only requires the motor to turn in one direction, the Forward/Reverse switch can be omitted.

The Inverter must be in external control mode to operate in 3-wire control. Check that the “EXT” indicator is illuminated to confirm. The PU/EXT key can be used to change the mode if required.

12. How to configure “3-Wire” control with Run/Stop pushbuttons and Forward/Reverse selection

The procedure described in section 7 enables Run/Stop operation via the red and green buttons on the Inverter keypad.

If this is unsuitable for the application, remote switches can be used instead.

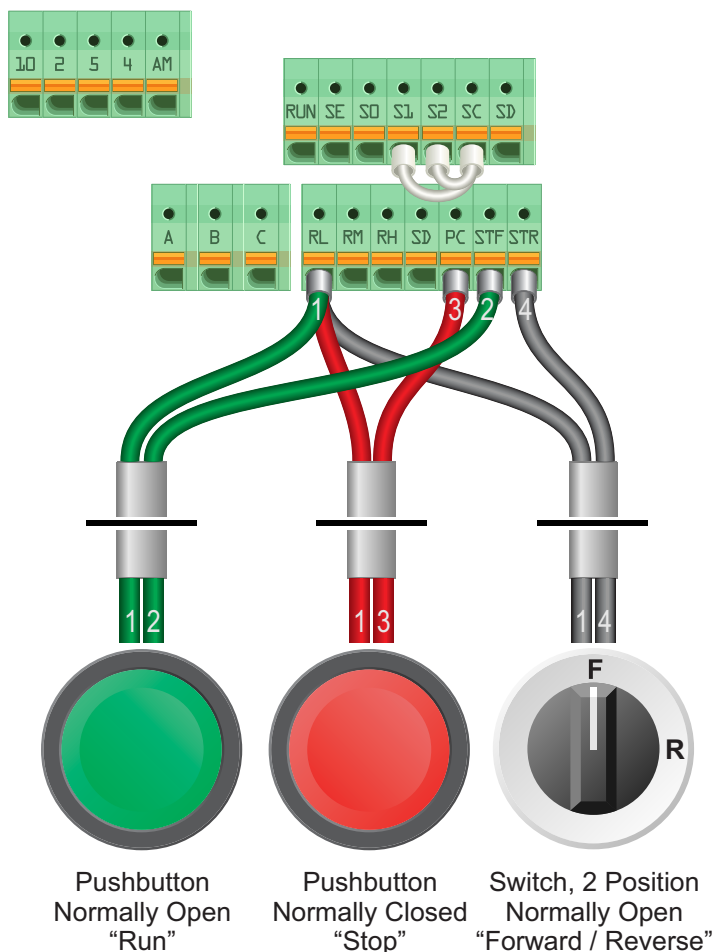
This section explains how to enable 3-wire control with Run and Stop via pushbuttons and Fwd/Rev via a selector switch.

The Inverter must be in “EXT” control mode to operate from the I/O terminals. Press PU/EXT to select.

12.1 Parameters to change for remote 3-wire control

Parameter	Description	How to set
Pr. 2	Minimum Speed	Set to 5.00 to run the motor at 5Hz if no other speed reference has been defined.
Pr. 160	Extended function display	Set to 0 to display both simple and extended parameters. This is the factory default.
Pr. 180	RL terminal function selection	Default is 0. Set to 25 to set the RL terminal as “Output Stop”.
Pr. 250	Stop selection	Default is 9999. Set to 8888 for Run with Forward/Reverse selection.

12.2 Connecting the Switches



The PC terminal is a common connection for terminals RL, RM, RH, STF and STR when the jumpers are set in “Source” (the default). If the jumpers have been changed to “Sink”, use SD as the common instead.

For “Run” and “Stop”, two suitable pushbuttons should be installed. The “Run” pushbutton should include a Normally Open contact between terminals RL and STF and the “Stop” a Normally Closed contact between RL and PC.

For “Forward/Reverse” a suitable 2 position NO (Normally Open) switch should be installed between RL and STR. A momentary connection between RL and STF will start the motor. It will continue to run until the connection between RL and PC is broken.

Note that the Forward/Reverse switch can only be used to set the direction when the motor is stopped. It will not change the direction once the motor is running. If this is not suitable, an alternate 3-wire configuration with Run Forward, Run Reverse and Stop is possible - refer to the manual for details.

The Inverter must be in external control mode to operate in 3-wire control. Check that the “EXT” indicator is illuminated to confirm. The PU/EXT key can be used to change the mode if required.

13. Brake Resistor Connection (if available)



Before commencing, confirm that the Inverter and all cables are completely isolated from the power supply, have been isolated for at least 5 minutes and that the motor is not turning.

High inertia loads can cause overvoltage trips during deceleration and lead to "E.OV3" error messages. In many cases, the solution is to increase the deceleration time to compensate.

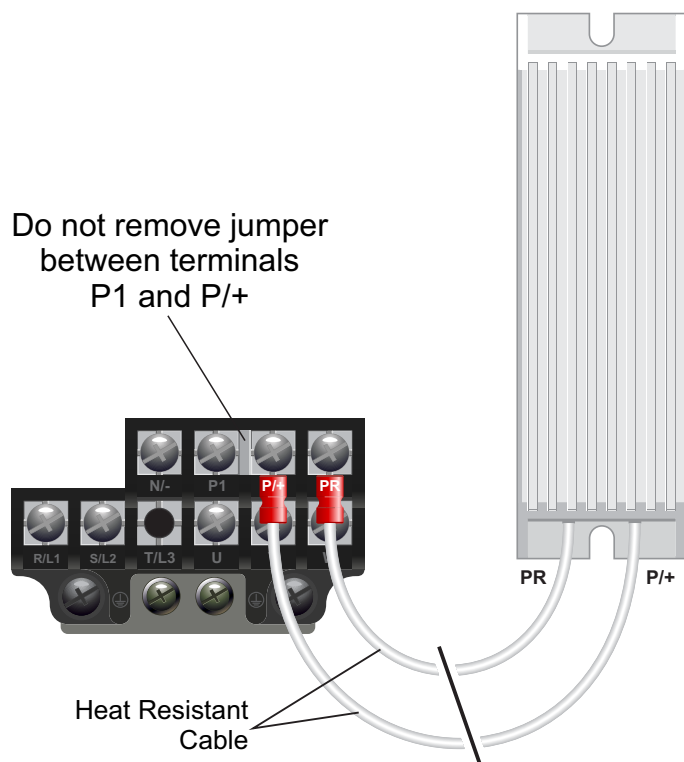
However, if the application requires it, dynamic braking can be enabled to maintain or reduce deceleration times by absorbing the energy generated by such loads.

A Brake Resistor is first installed to absorb braking energy and dissipate it as heat. The resistor must be correctly sized for both the Inverter and application.

Then, the "brake chopper" within the Inverter is enabled. This detects excessive braking energy and redirects it to the resistor when required.

13.1 Parameters to change for Dynamic Braking

Parameter	Description	How to set
Pr. 30	Regenerative function selection	Default is 0. Set to 1 to enable integrated brake chopper (if fitted).
Pr. 70	Special regenerative brake duty	Default is 0%. Set to 10% or as required by the application.



13.2 Connecting the Resistor

A wiring diagram is shown in the illustration opposite. Connect the brake resistor to the PR and P/+ terminals on the Inverter. The order of the connections is unimportant.

The braking resistor may get hot during operation. Ensure that it is suitably-mounted so any heat generated will not affect other equipment. Some resistors may include a thermal relay for additional protection.

It is essential that a resistor of the correct rating is used. Consult the product manual issued by the manufacturer or product listing on InverterDrive.com for further information.

Note: Some smaller D720S Inverters do not have integrated dynamic braking. The illustration opposite is based on the 230V Single Phase frame size at 0.75kW. Other ratings and frame sizes are similar.

14. How to reset the Inverter to Factory Defaults



14.1 Select “PU” operation mode.

With the motor stopped, press the “PU/EXT” key repeatedly to cycle through operation modes until the “PU” indicator is illuminated and “0.00” is displayed.

Note: This ensures that the control mode is set to “Parameter Unit” ie. the motor is controlled using the integrated keypad on the front of the Inverter.



14.2 Change mode to “Parameter setting”.

Press the “MODE” key repeatedly until the “PRM” indicator is illuminated. The display will show “P. 0” as shown opposite.

Note: The display may show the last selected parameter instead of “P. 0”.



14.3 Select the “ALLC” parameter.

Use the dial to scroll through the parameters to “ALLC”.

Press the “SET” key to select parameter “ALLC”. The display will show the initial parameter value of “0”.



14.4 Change the parameter value from 0 to 1 and set.

Use the dial to change the value to “1” and press “SET”. The display will flash between “ALLC” and “1”. Press the “SET” key again to confirm. If the display flashes “Er4” ensure that the “PU” operation mode has been selected.

The display will return to the initial parameter value of “0”. Press the set key again to return to the parameter list. The next parameter in the list “Er.CL” will be displayed. All parameter values have now been reset.