INVERTER DRIVE SUPERMARKET

Easy Start Guide

LS Industrial Systems
Starvert SV-iC5 Frequency Inverter
available from LS.InverterDrive.com

This guide is intended to compliment 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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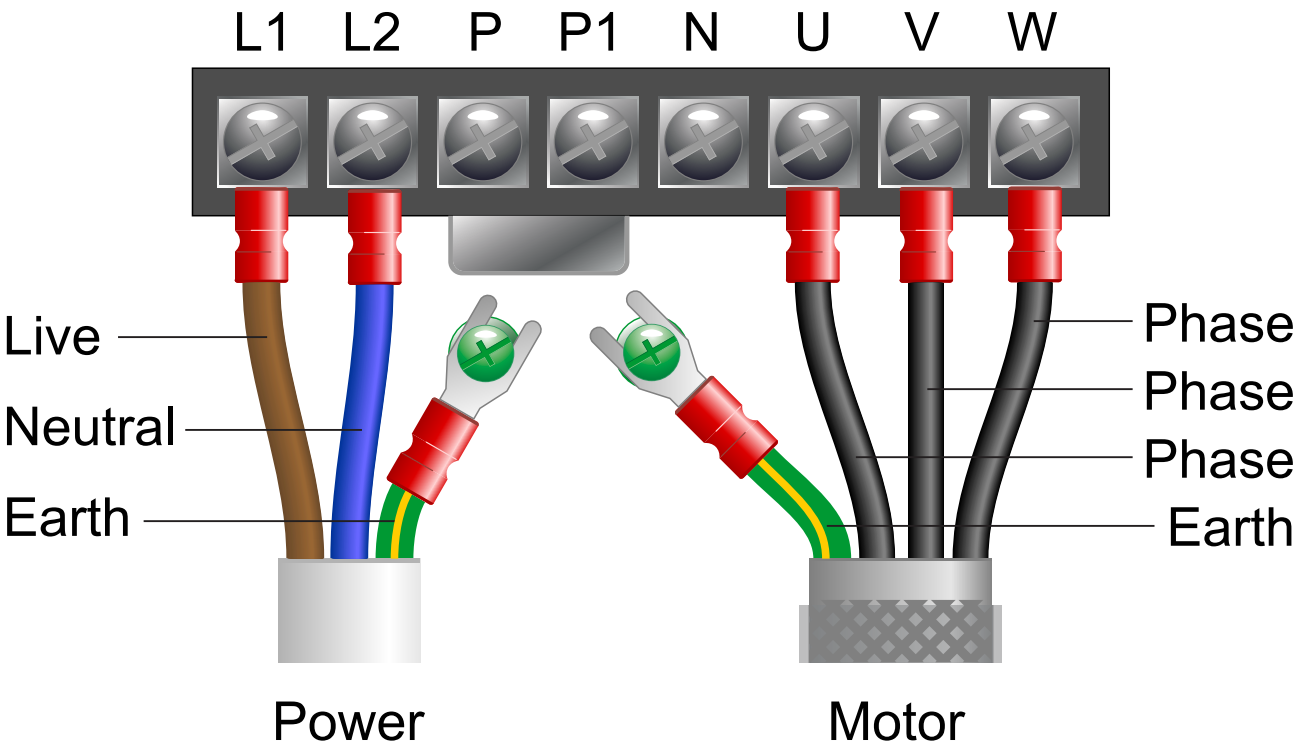
1. Power and Motor Connections

Before commencing, confirm that the iC5 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 1.5kW and 2.2kW models. The terminal layout for 0.37kW and 0.75kW models is slightly different.

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

The smaller green earth terminals are not part of the main termal block.

Important:

Do NOT connect Neutral to the terminal marked N.

Use screened SY cable between the Inverter and Motor to minimise electromagnetic interference.

Ensure the motor cable screen is earthed at the motor end.

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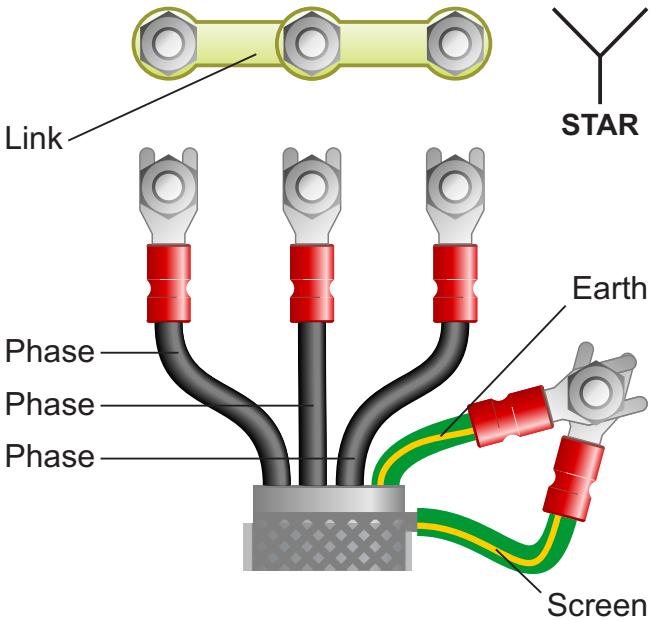
2. Motor Connections - Star and Delta

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).



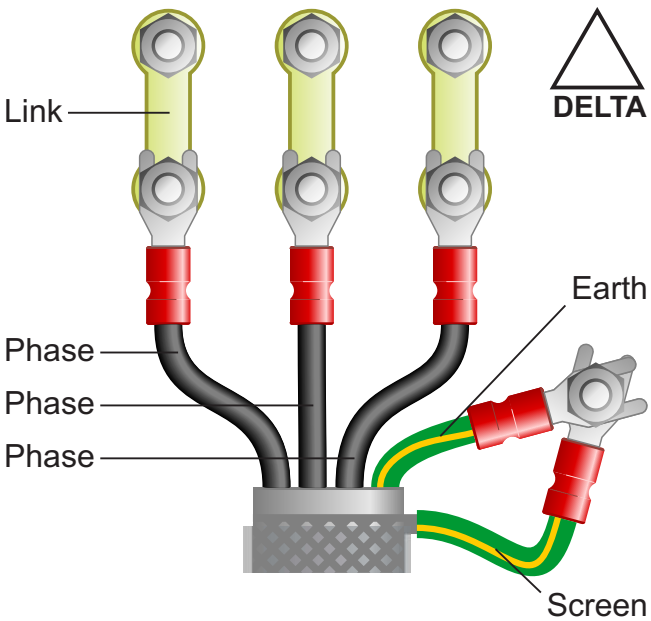
2.1 Motor connected in STAR (or Wye):

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.



2.2 Motor connected in DELTA:

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

The LS SV-iC5 converts Single Phase 230V to Three Phase 230V so a 230/400V Motor should be connected in Delta.

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.

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3. Parameters - overview

The iC5 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. F21 = Max Output Frequency) with a description available in the manual.

The parameters contain critical information essential to the correct operation of the iC5. Therefore, they should at least be checked by the user before it is operated for the first time.
The parameters listed in section 4 are intended to provide a starting point to allow for basic operation of the iC5 Inverter.

4. Parameters to set before use

Set the following parameters to allow the iC5 to run in standard mode with Run, Stop and Speed Control from the integral keypad.

If any of the parameters have been changed previously, follow the procedure in section 12 to reset the iC5 to Factory Defaults.

4.1 Parameters in the Drive Group

Press left/right to find 0.0 then up/down to find parameter

Parameter	Description	How to set
drv	Run/Stop Command Source	Set to **0** for Run/Stop buttons on the iC5.
Frq	Speed Command Source	Set to **2** to use the dial on the iC5.

4.2 Parameters in Function Group 1 - “F”

Press left/right to find F0 then up/down to find parameter number

Parameter	Description	How to set
F21	Max Output Frequency in Hz	Default is 60. Change to 50 to limit all frequency-related parameters except F22 to 50Hz.
F22	Base Frequency	Default is 60. Change to 50 for 50Hz motor.
F24	Enable Max/Min Frequency	Default is 0 (off). Set to 1 to enable parameters F25 and F26 for future use.
F25	Frequency high limit	Default is 60. Change to 50 to limit maximum run speed to 50Hz.
F26	Frequency low limit	Default is 0.5. Change as required to limit minimum run speed in Hz.
F27	Torque Boost	Default is 0 (off). Set to 1 to improve starting Torque.
F50	Thermal Overload	Default is 0 (off). Set to 1 to enable Thermal Overload Protection.

4.3 Parameters in Function Group 2 - “H”

Press left/right to find H0 then up/down to find parameter number

Parameter	Description	How to set
H30	Motor Power in kW	Set to match motor nameplate - eg. 0.75 for 0.75kW, 1.5 for 1.5kW etc.
H31	Number of Motor Poles	Set to match motor nameplate - eg. 2700-3000RPM = 2, 1350-1500RPM = 4 etc.
H32	Motor Slip in Hz	Calculate: (Motor Frequency - ((Motor RPM x Poles) / 120))
H33	Motor Full Load Current in Amps	Set to match motor nameplate - eg. 4.7
H34	Motor No-Load Current in Amps	*See section 5 for details of how to correctly set this value.*

4.4 Parameters in the I/O Group - “I”

Press left/right to find I0 then up/down to find parameter number

Parameter	Description	How to set
I5	Max Potentiometer Frequency	Default is 60. Change to 50 for 50Hz output when the keypad potentiometer is at maximum.

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5. How to set “Motor no-load current” - H34

Motor no load current is an important parameter to set to get the best possible motor performance.

Correctly set, it allows the Inverter to maintain the precise output current to suit the motor and significantly improves torque at lower speeds.

The procedure involves running the motor off-load at it’s rated speed and making a note of output current. This value is then set in parameter H34.
Once set, this can be confirmed by running the motor off-load at 50Hz and 5Hz and noting that the output current is the same in both cases.

5.1 How to determine “Motor no-load current” by operating the iC5.

5.1.1 Use the dial to set the frequency to 50Hz and start the motor.

Motor no-load current can only be determined with the motor running off-load. Decouple the motor from the machine before beginning!

Turn the dial clockwise until the display shows 50.0 as illustrated opposite. Then press the green “Run” button to start the motor. As the motor accelerates the display will track frequency from 0.0 to 50.0.

Once the Inverter has reached 50.0Hz proceed to the step below.

5.1.2 Use the navigation pad to locate the “CUr” parameter.

Press the down arrow on the navigation pad until “CUr” is displayed (as shown opposite). “CUr” is a read-only parameter which displays output current in Amps.

Press the navigation pad to select “Cur”. The output current will be displayed.

Make a note of this value. It is “Motor no-load current” in Amps and must be set in parameter H34.

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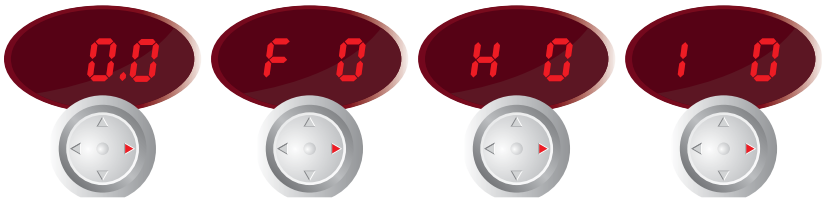
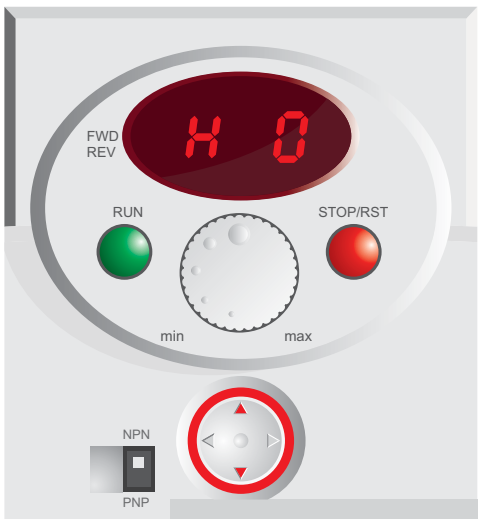
6. How to set a Parameter value

6.1 Use the left and right arrows on the navigation pad to move between parameter groups.

From the initial screen (shown opposite), press the right arrow on the navigation pad to move between each of the four parameter groups. Select “H0".



Drive Group | Function Group 1 “F” | Function Group 2 “H” | I/O Group



6.2 Use the up and down arrows on the navigation pad to move between parameters within the selected parameter group.

In this example, we will set Parameter H33 (Function Group 2 “H”, Parameter number 33) which is motor rated current.

Press the up arrow on the navigation pad repeatedly to move from H0 to H1, H2, H3 etc. until you reach H33.

6.3 Press the navigation pad to edit a parameter.

Once the desired parameter is shown on the display, in this case H33, press the navigation pad to select it.

In some cases, it is possible to accidentally press an arrow key instead of the navigation pad. In this case, ensure you re-select parameter H33 before attempting to press the navigation pad again.

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6.4 Use the left and right arrows on the navigation pad to move between digits. Use the up and down arrows to increase or decrease the digit value.

In this example, the motor nameplate states 4.7A at 230V so we will change the default value from 5.0 to 4.7.

Press up to change to 0 to 7

Press left to change digit

Press down to change 5 to to 4

6.5 Press the navigation pad to save changes. Press the navigation pad again to confirm.

Once the value of H33 has been changed to 4.7 press the navigation pad to save changes.

The display will then flash indicating that the change needs to be confirmed.

Press the navigation pad again to confirm the change or wait to cancel the change and return to the edit screen in the previous step.

6.6 Parameter value is set.

Now H33 has been successfully set. The screen will return to the parameter list.

Repeat the steps above to set the value of other parameters. See section 4 for recommended settings.

Press the left or right keys on the navigation pad to return to the Drive Group (ie. the group which does not start with F, H or I).

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7. How to operate the Inverter

7.1 Use the dial to set the required speed.

Turn the dial clockwise to increase speed and anti-clockwise to decrease speed.

The display will change to show the current speed frequency reference in Hz.

7.2 Press the green "Run" button to start the motor.

The green "Run" button will start the motor. The motor will accelerate to the speed set by the dial (see step 1 above) in the time defined by the "ACC" parameter found in the "Drive" parameter group.

Motor speed can be changed whilst the motor is running by turning the dial clockwise (faster) or anti-clockwise (slower).

When the motor is running, the "FWD" light will be displayed.

7.3 Press the red "Stop/Rst" button to stop the motor.

The red "Stop/Rst" button will stop the motor.

The time taken (in seconds) to stop the motor is determined by the "dEC" parameter which can be found in the "Drive" parameter group.

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8. How to enable Sensorless Vector Mode

The standard operating mode of the iC5 Inverter is VxF. This is the simplest form of operation and controls Volts and Frequency to vary the speed of a standard Induction Motor.

The iC5 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.
This requires an “ID” run during which the Inverter runs the motor for approx. 1 minute at various speeds to gather the necessary data.
Decouple the motor from the machine before starting an ID run.

8.1 Parameters in Function Group 2 - “H”

Press left/right to find H0 then up/down to find parameter number

Parameter	Description	How to set
H40	Control Mode	Default is 0. Change to 3 to enable Sensorless Vector Mode.
H41	Auto-tuning	Default is 0. Ensure motor is off-load before changing to 1 to begin ID run.

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

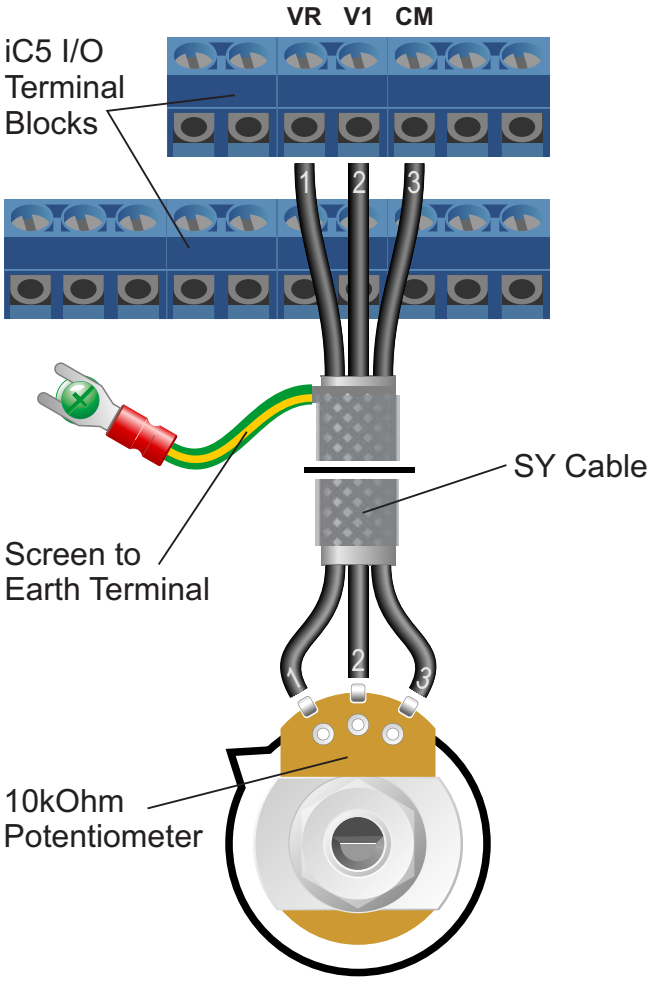
If the integrated speed control dial is unsuitable for the application, a remote Potentiometer can be used instead.
This provides the benefit of allowing motor speed to be controlled from a more convenient location such as a cabinet door (if the iC5 is cabinet-mounted) or on the machine itself.

A Potentiometer of **10kOhm** rating should be used.
The number of turns depends on the application but both single turn and ten turn Potentiometers are available from The Inverter Drive Supermarket at InverterDrive.com.

9.1 Parameters to change in the Drive Group

Press left/right to find 0.0 then up/down to find parameter number

Parameter	Description	How to set
Frq	Speed Command Source	Set to **3** to enable 0-10V via 10kOhm Potentiometer
I9	V1 input max voltage	Set to **10** to enable maximum speed at 10V (potentiometer rotated to maximum)
I10	Frequency corresponding to I9	Set to **50** for 50Hz output frequency at 10V. Can be increased/decreased if required.



9.2 Connecting the Potentiometer

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 10 volts and should be connected to the V1 terminal at the Inverter end. It is this voltage which provides the speed signal with 0V being slowest and 10V fastest.

If the rotation of the Potentiometer is the opposite to that required (ie. turn anti-clockwise to increase speed instead of clockwise) reverse connections VR and CM.

Use shielded SY cable between Potentiometer and Inverter and ensure that the cable screen is earthed at the green earth terminal on the Inverter.

Note: Parameter I10 cannot exceed the maximum frequency limit set in parameter F25 (see section 4).

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10. How to connect and configure a Run/Stop switch

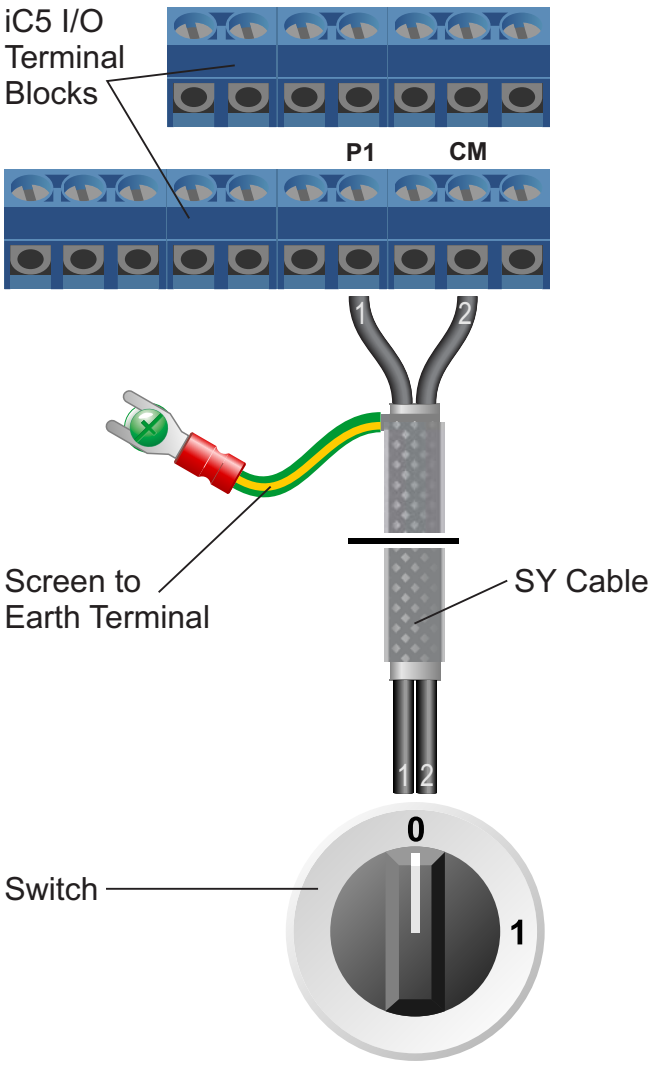
The parameters described in Section 4 enable Run/Stop operation via the red and green buttons on the Inverter.
If this is unsuitable for the application, a remote Run/Stop switch can be used instead.

Note that once this procedure is complete, the Run/Stop buttons on the Inverter can no longer be used.
Important: P1 refers to the P1 I/O terminal and NOT the P1 power terminal.

10.1 Parameters to change in the Drive Group

Press left/right to find 0.0 then up/down to find parameter number

Parameter	Description	How to set
drv	Run/Stop Command Source	Set to **1** for Programmable Input 1 “P1".



10.2 Connecting the Switch

A wiring diagram is shown in the illustration opposite.

The CM terminal output is 24V DC when the Inverter is connected to a power supply. This is provided as a 24V output only and has no other function.

When the P1 terminal receives 24V (ie. when the circuit with CM is complete), Run is enabled and motor will turn. Conversely, when it receives 0V (ie. when the circuit with CM is broken), Run is disabled and the motor will stop.
This behaviour is known as a **Digital Input**.

Any 24V DC signal connected to P1 will cause the Inverter to run. This can be useful if an external source such as a PLC is controlling the Inverter. If the 24V DC signal is external, a connection to CM is not required.

Use shielded SY cable between the switch and Inverter and ensure that the cable screen is earthed at the green earth terminal on the Inverter.

Note that although 2 core SY cable is shown in the illustration opposite, multi-core SY cable can be used if several digital inputs are to be used.

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11. How to connect and configure a Fwd/Rev switch

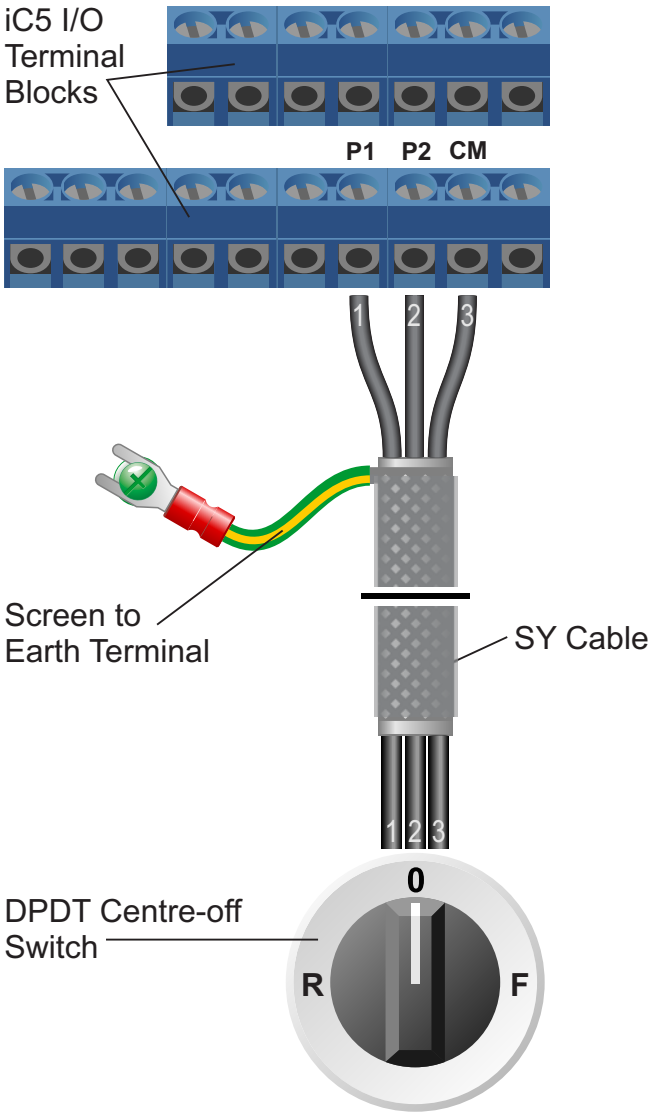
The parameters described in Section 4 enable Run/Stop operation via the red and green buttons on the Inverter.
Section 10 explains how to enable remote Run/Stop via a switch instead.

This section extends the functionality added in section 10 to include Run Forward/ Reverse as well as Stop.
Important: P1 and P2 refer to the P1 / P2 I/O terminals NOT P1 / P2 power terminals.

11.1 Parameters to change in the Drive Group (skip if section 10 completed)

Press left/right to find 0.0 then up/down to find parameter number

Parameter	Description	How to set
drv	Run/Stop Command Source	Set to **1** for Programmable Input 1 “P1".



11.2 Connecting the Switch

A wiring diagram is shown in the illustration opposite. The switch used is a DPDT centre off type.

The CM terminal provides a 24V DC output as described in section 10.

When the switch is moved to the “F” (Forward) position, the circuit between P1 and CM is completed and the motor will turn forwards as described in section 10.
In addition, when the switch is moved to the “R” (Reverse) position, the circuit between P2 and CM is completed and the motor will turn in reverse.
Returning the switch to position “0" (off) will stop the motor.
This behaviour uses two **Digital Inputs**.

If both P1 and P2 receive 24V signals, the motor will stop.

Any 24V DC signal from an external source such as a PLC connected to P1 or P2 will cause the Inverter to run forwards or backwards.

Use shielded SY cable between the switch and Inverter and ensure that the cable screen is earthed as described in section 10.

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12. How to reset the Inverter to Factory Defaults

12.1 Use the navigation pad to navigate to parameter H93.

From the home screen, press the right arrow on the navigation pad twice to move to Parameter function group 2 “H”.

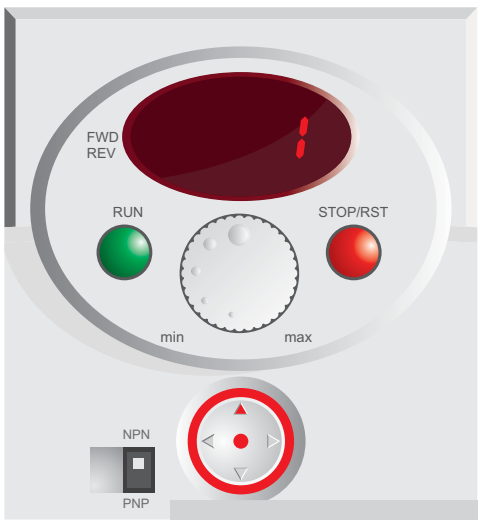
Then, press the down arrow three times to navigate to “H93".

Note: If you are unsure if the display is showing the home screen, power-off the iC5 for 60 seconds before switching back on.

12.2 Press the navigation pad to change the value of parameter H93.

Once the display shows “H93", press the navigation pad to select the parameter and edit it’s value.

The display will show the default value of “0".



12.3 Press the up arrow on the navigation pad to change the value from 0 to 1.

Press the up arrow on the navigation pad once to change the value of H93 from 0 to 1.

Press the navigation pad to save the changes. The display will flash to indicate that the change needs to be confirmed.

Press the navigation pad again to confirm the change. The display will return to H93.

All parameters have now been reset to factory defaults.

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13. Notes

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