# Datasheet of iCL Series Integrated Stepper Motor

Leadshine

## iCL Series Integrated Stepper Motor

iCL series is integrated stepper motor with 14-bit magnetic encoder to solve the loss of step problems in open loop stepper control systems, thus increase system reliability at minimal cost increase. It implements advanced control algorithm of Leadshine based on its tens of years' experience in stepper and servo controls. At very compact size and with all components integrated, the iCS can save mounting space, eliminate encoder connection & motor wiring time, reduce interference, and cut/reduce cable and labor costs.

The iCL series is reliable, affordable and excellent in many industrial applications such as CNC, 3D printer, stage equipment, medical, electronics, packaging...etc.

- Feature
- No loss of step & no torque reservation & no hunting or overshooting & no tuning for easy setup
- Enhance performance, especially at low speed application (<60RPM)
- Soft-start with no "jump" when powered on
- Low noise and vibration, smooth motion
- Step&direction and CW&CCW control
- 3 digital inputs, 1 optically isolated digital output
- 14-bit single-turn incremental encoder
- RS232 communication for Leadshine software connection
- Over voltage, over current, position following error protections, etc.

- Model Designation

iCL - 42 03 □

| Series Name |
| --- |
| iCL:Integrated closed loop stepper motor |

| Frame Size |
| --- |
| 42:NEMA17 |
| 57:NEMA23 |
| 60:NEMA24 |

| Holding Torque |
| --- |
| 03: 0.3N.m |
| 06: 0.6N.m |
| 08: 0.8N.m |
| 13: 1.3N.m |
| 23: 2.3N.m |
| 21: 2.1N.m |
| 31: 3.1N.m |
| 30: 3.0N.m |
| 35: 3.5N.m |

| Remark |
| --- |
| Blank:Normal type |
| Special type |

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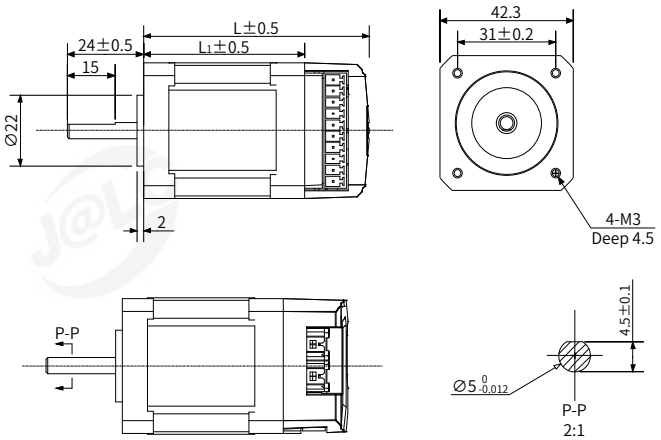
Technical Specification

| Model | Frame Size | Length(mm) | Holding Torque(N.m) | Weight(Kg) | Command Source | |
|---|---|---|---|---|---|---|
| | | | | | PUL & DIR | CW & CCW |
| iCL42-03 | NEMA17 | 64 | 0.3 | 0.5 | √ | x |
| iCL42-06 | | 72 | 0.4 | 0.9 | √ | x |
| iCL42-08 | | 85 | 0.8 | 1.1 | √ | x |
| iCL57-13 | NEMA23 | 75 | 1.3 | 1.0 | √ | √ |
| iCL57-23 | | 96 | 1.9 | 1.3 | √ | √ |
| iCLD57-21 | | 89 | 2.1 | 1.4 | √ | √ |
| iCLD57-31 | | 109 | 3.1 | 1.6 | √ | √ |
| iCL60-30 | NEMA24 | 109 | 3.0 | 1.6 | √ | √ |
| iCL60-35 | | 122 | 3.5 | 1.9 | √ | √ |

| Model | Electrical Parameters | | Control Signal | | | | |
|---|---|---|---|---|---|---|---|
| | Power Voltage (VDC) | Peak Current (A) | Logical Current | Logical Voltage | Max Input Frequency | MIN PUL Width | MIN DIR Setup |
| iCL42-03 | 20-36 | 0.3- 3.0 | 7-16mA | 5V | 200KHz | 2.5μs | 5.0μs |
| iCL42-06 | 20-36 | 0.3- 3.0 | | | | | |
| iCL42-08 | 20-36 | 0.3- 3.0 | | | | | |
| iCL57-13 | 20-50 | 0.3- 4.5 | | | | | |
| iCL57-23 | 20-50 | 0.3- 7.0 | | | | | |
| iCLD57-21 | 20-50 | 0.3- 7.0 | | | | | |
| iCLD57-31 | 20-50 | 0.3- 7.0 | | | | | |
| iCL60-30 | 20-50 | 0.3- 7.0 | | | | | |
| iCL60-35 | 20-50 | 0.3- 7.0 | | | | | |

Dimension
(Unit: mm [1inch=25.4mm])




| Model | L1 Length | L Length |
|---|---|---|
| iCL42-03 | 43 | 64 |
| iCL42-06 | 51 | 72 |
| iCL42-08 | 64 | 85 |

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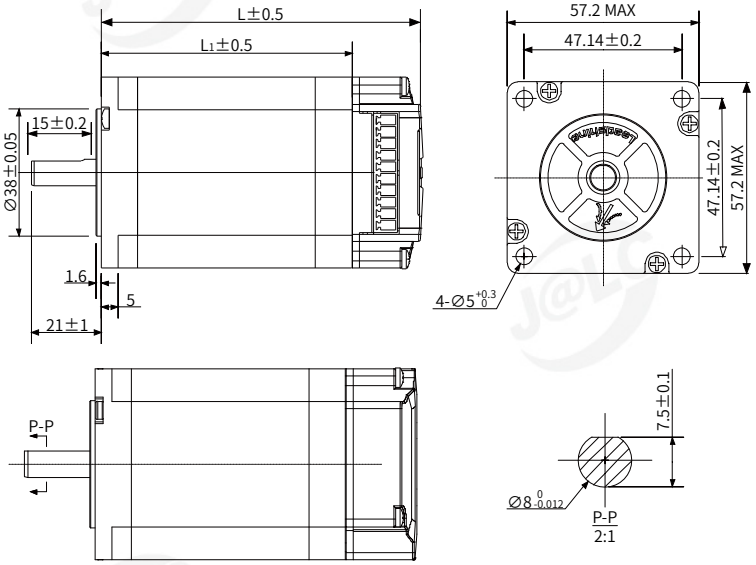
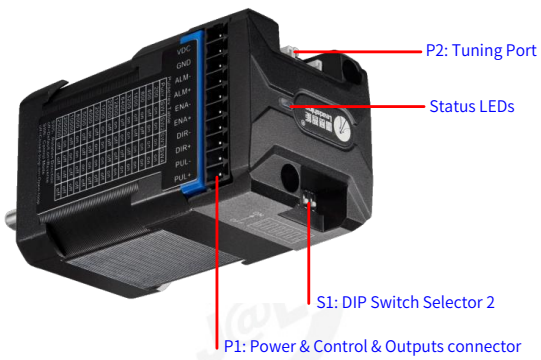



| Model | L1 Length | L Length |
|---|---|---|
| iCL57-13 | 54 | 75 |
| iCL57-23 | 75 | 96 |
| iCLD57-21 | 68 | 89 |
| iCLD57-31 | 88 | 109 |
| iCL60-30① | 88 | 109 |
| iCL60-35② | 101 | 122 |

Note:
① Frame size is 60mm, center diameter is 36mm.
②Frame size is 60mm, center diameteris 36mm, shaft diameter is 10mm.

## Connector and Pin Assignment




| PIN | I/O | Details |
|---|---|---|
| VCC | I | Power supply positive connection.<br>iCL42xx:20-36VDC<br>iCL57xx and iCL60-24xx: 20-50 VDC |
| GND | I | Power supply ground connection. |
| ALM- | O | Alarm: An OC output signal. It takes a sinking or sourcing at 5-24V@30mA |
| ALM+ | O | |
| ENA- | I | Enable Signals: Optional, not connected by default.<br>(1) Effective high level is 4.5-5V; Effective low level is 0-0.5V connection<br>(2) ENA signal requires advance DIR signal minimum 200ms in single pulse mode |
| ENA+ | I | |
| DIR- | I | Pulse and Direction Connection:<br>(1) Optically isolated, high level 4.5-5V, low voltage 0-0.5V.<br>(2) Max 200 KHz input frequency.<br>(3) The width of PUL signal is at least 2.5μs, duty cycle is recommended 50%.<br>(4) Single pulse (step & direction), iCL57xx and iCL60xx support double pulse (CW&CCW), while iCL42xx do not support.<br>(5) DIR signal requires advance PUL signal minimum 5 μs. |
| DIR+ | I | |
| PUL- | I | |
| PUL+ | I | |

Notes:
(1) Shielding control signal wires is suggested;
(2) To avoid/reduce interference, do not tie control signal cables and power wires together.

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- Tuning Port P2

The P2 connector is a RS232 communication port for Leadshine software connection. It is just used to modify parameter, not for equipment control because neither precision nor stability is sufficient. If you need a Modbus-RS485 control, use a Leadshine iDM-RS series integrated stepper motor. The interface definition is as follows:

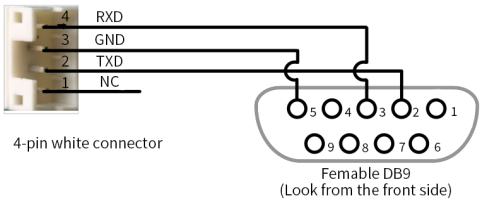
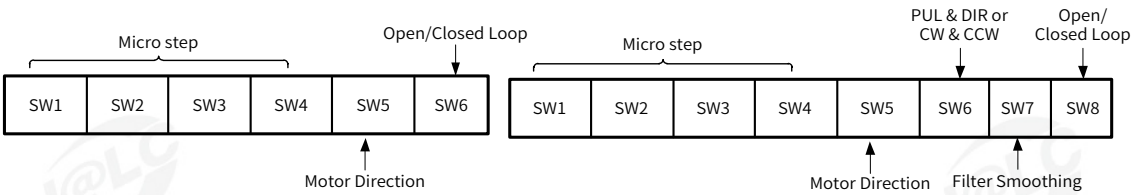



Figure5: RS232 Tuning Port

- DIP Switch Configurations

The iCL series has a row of DIP switches, but the iCL42xx and iCL57-xx DIP switches are a bit different, as follows




- For iCL42xx Series

Microstep resolution is set by SW1, 2, 3, 4 of the DIP switches as shown in the following table:

| Steps/Revolution | SW1 | SW2 | SW3 | SW4 |
|---|---|---|---|---|
| 200(Default) | on | on | on | on |
| 400 | off | on | on | on |
| 800 | on | off | on | on |
| 1600 | off | off | on | on |
| 3200 | on | on | off | on |
| 6400 | off | on | off | on |
| 12800 | on | off | off | on |
| 25600 | off | off | off | on |
| 1000 | on | on | on | off |
| 2000 | off | on | on | off |
| 4000 | on | off | on | off |
| 5000 | off | off | on | off |
| 8000 | on | on | off | off |
| 10000 | off | on | off | off |
| 20000 | on | off | off | off |
| 25000 | off | off | off | off |

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For iCL57xx and iCL60xx Series

| Steps/Revolution | SW1 | SW2 | SW3 | SW4 |
|---|---|---|---|---|
| 400(Default) | on | on | on | on |
| 800 | off | on | on | on |
| 1600 | on | off | on | on |
| 3200 | off | off | on | on |
| 6400 | on | on | off | on |
| 12800 | off | on | off | on |
| 25600 | on | off | off | on |
| 51200 | off | off | off | on |
| 1000 | on | on | on | off |
| 2000 | off | on | on | off |
| 4000 | on | off | on | off |
| 5000 | off | off | on | off |
| 8000 | on | on | off | off |
| 10000 | off | on | off | off |
| 20000 | on | off | off | off |
| 40000 | off | off | off | off |

Other DIP Switch Settings
For iCL42xx Series (SW5-SW6)

| | Function | On | Off |
|---|---|---|---|
| SW5 | Default Direction | CW (clockwise) | CCW (counterclockwise) |
| SW6 | Closed/Open loop | Open Loop | Closed Loop |

For iCL57xx and iCL60xx Series (SW5-SW8)

| | Function | On | Off |
|---|---|---|---|
| SW5 | Default Direction | CW (clockwise) | CCW (counterclockwise) |
| SW6 | Pulse Mode | CW&CCW | PUL&DIR |
| SW7 | Smoothing Time | Enable | Disable |
| SW8 | Closed/Open Loop | Open Loop | Closed Loop |

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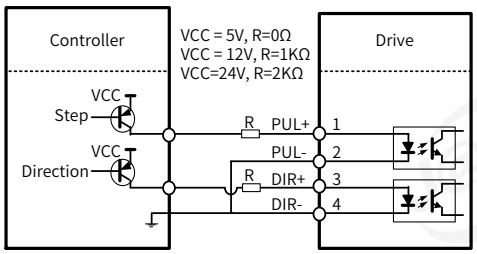
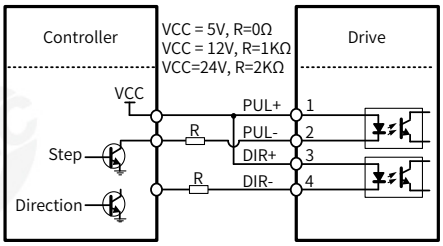
## Wiring

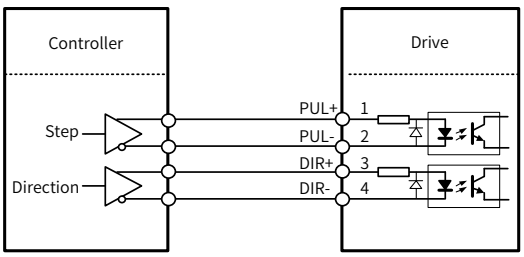
The iCL series motor can accept differential and single-ended control signal inputs (open-collector and PNP output). It has 3 optically isolated control inputs,PUL, DIR, and ENA. Refer to the following two figures for connections of PNP and NPN signals.




Connections to PNP signals
(common-cathode)




Connections to NPN Signals
(common-anode)




Connections to Differential signals