## Connection and Operation

## - Names and Functions of Driver Parts



4 Input/Output Signals

| Indication | Input/ Output | Pin No. | Signal Name | Function |
| :---: | :---: | :---: | :---: | :---: |
| CN2 | Input | 1 | Pulse Signal (CW Pulse Signal) | Operation command pulse signal <br> (The motor will rotate in the CW direction when in 2-pulse input mode.) |
|  |  | 2 |  |  |
|  |  | 3 | Rotation Direction Signal (CCW Pulse Signal) | Rotation direction signal <br> Photocoupler OFF: CCW, photocoupler ON: CW <br> (The motor will rotate in the CCW direction when in 2-pulse input mode.) |
|  |  | 4 |  |  |
|  |  | 5 | All Windings Off Signal | Turns off the output current to the motor so that the motor shaft can be rotated by external force |
|  |  | 6 |  |  |
|  |  | 7 | Resolution Select Signal | Switches to the resolution set in DATA1 and DATA2 |
|  |  | 8 |  |  |
|  |  | 9 | Automatic Current Cutback Release Signal | Disables the automatic current cutback function |
|  |  | 10 |  |  |
|  | Output | 11 | Excitation Timing Signal | This signal is output when the excitation sequence is in step "0." |
|  |  | 12 |  |  |

5 Resolution Setting Switches

| Indication | Switch Name |  |
| :---: | :---: | :---: |
| DATA1 | Resolution Setting Switch | Each switch can be set to the desired resolution from the 16 resolution levels. |
| DATA2 |  |  |

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DRL20, DRL28 With the high-resolution motor, the resolution is one-half the values specified below.

| R1 |  |  | R2 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Resolution Setting Switch | Microsteps/ | Resolution 1 | Resolution Setting Switch | Microsteps/ | Resolution 2 |
| DATA1 DATA2 |  |  | DATA1 DATA2 |  | mm (in.) |
| 0 | 1 | 0.002 (0.000079) | 0 | $\times 2.5$ | 0.005 (0.00020) |
| 1 | 2 | 0.001 (0.000039) | 1 | $\times 1.25$ | 0.0025 (0.000098) |
| 2 | 2.5 | 0.0008 (0.000031) | 2 | 1.6 | 0.00125 (0.000049) |
| 3 | 4 | 0.0005 (0.00002) | 3 | 2 | 0.001 (0.000039) |
| 4 | 5 | 0.0004 (0.000016) | 4 | 3.2 | 0.000625 (0.000025) |
| 5 | 8 | 0.00025 (0.0000098) | 5 | 4 | 0.0005 (0.000020) |
| 6 | 10 | 0.0002 (0.0000079) | 6 | 6.4 | 0.0003125 (0.000012) |
| 7 | 20 | 0.0001 (0.0000039) | 7 | 10 | 0.0002 (0.0000079) |
| 8 | 25 | 0.00008 (0.0000031) | 8 | 12.8 | 0.00015625 (0.0000062) |
| 9 | 40 | 0.00005 (0.000002) | 9 | 20 | 0.0001 (0.0000039) |
| A | 50 | 0.00004 (0.0000016) | A | 25.6 | 0.000078125 (0.0000031) |
| B | 80 | 0.000025 (0.00000098) | B | 40 | 0.00005 (0.0000020) |
| C | 100 | 0.00002 (0.00000079) | C | 50 | 0.00004 (0.0000016) |
| D | 125 | 0.000016 (0.00000063) | D | 51.2 | 0.0000390625 (0.0000015) |
| E | 200 | 0.00001 (0.00000039) | E | 100 | 0.00002 (0.00000079) |
| F | 250 | 0.000008 (0.00000031) | F | 102.4 | 0.00001953125 (0.00000077) |

DRL42 With the high-resolution motor, the resolution is one-half the values specified below.

| R1 |  |  | R2 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Resolution Setting Switch | Microsteps/ | Resolution 1 | Resolution Setting Switch | Microsteps/ | Resolution 2 |
| DATA1 DATA2 | Step 1 | mm (in.) | DATA1 DATA2 | Step 2 | mm (in.) |
| 0 | 1 | 0.004 (0.00016) | 0 | $\times 2.5$ | 0.01 (0.00039) |
| 1 | 2 | 0.002 (0.000079) | 1 | $\times 1.25$ | 0.005 (0.00020) |
| 2 | 2.5 | 0.0016 (0.000063) | 2 | 1.6 | 0.0025 (0.000098) |
| 3 | 4 | 0.001 (0.000039) | 3 | 2 | 0.002 (0.000079) |
| 4 | 5 | 0.0008 (0.000031) | 4 | 3.2 | 0.00125 (0.000049) |
| 5 | 8 | 0.0005 (0.00002) | 5 | 4 | 0.001 (0.000039) |
| 6 | 10 | 0.0004 (0.000016) | 6 | 6.4 | 0.000625 (0.000025) |
| 7 | 20 | 0.0002 (0.0000079) | 7 | 10 | 0.0004 (0.000016) |
| 8 | 25 | 0.00016 (0.0000063) | 8 | 12.8 | 0.0003125 (0.000012) |
| 9 | 40 | 0.0001 (0.0000039) | 9 | 20 | 0.0002 (0.0000079) |
| A | 50 | 0.00008 (0.0000031) | A | 25.6 | 0.00015625 (0.0000062) |
| B | 80 | 0.00005 (0.000002) | B | 40 | 0.0001 (0.0000039) |
| C | 100 | 0.00004 (0.0000016) | C | 50 | 0.00008 (0.0000031) |
| D | 125 | 0.000032 (0.0000013) | D | 51.2 | 0.000078125 (0.0000031) |
| E | 200 | 0.00002 (0.00000079) | E | 100 | 0.00004 (0.0000016) |
| F | 250 | 0.000016 (0.00000063) | F | 102.4 | 0.0000390625 (0.0000015) |

DRL60 With the high-resolution motor, the resolution is one-half the values specified below.

| R1 |  |  | R2 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \hline \text { Resolution Setting Switch } \\ \hline \text { DATA1 DATA2 } \end{gathered}$ | $\begin{array}{\|c\|} \hline \text { Microsteps/ } \\ \text { Step } 1 \end{array}$ | Resolution 1 mm (in.) | $\begin{array}{\|c\|} \hline \text { Resolution Setting Switch } \\ \hline \text { DATA1 DATA2 } \\ \hline \end{array}$ | Microsteps/ Step 2 | Resolution 2 mm (in.) |
| 0 | 1 | 0.008 (0.00031) | 0 | $\times 2.5$ | 0.02 (0.00079) |
| 1 | 2 | 0.004 (0.00016) | 1 | $\times 1.25$ | 0.01(0.00039) |
| 2 | 2.5 | 0.0032 (0.00013) | 2 | 1.6 | 0.005 (0.00020) |
| 3 | 4 | 0.002 (0.000079) | 3 | 2 | 0.004 (0.00016) |
| 4 | 5 | 0.0016 (0.000063) | 4 | 3.2 | 0.0025 (0.000098) |
| 5 | 8 | 0.001 (0.000039) | 5 | 4 | 0.002 (0.000079) |
| 6 | 10 | 0.0008 (0.000031) | 6 | 6.4 | 0.00125 (0.000049) |
| 7 | 20 | 0.0004 (0.000016) | 7 | 10 | 0.0008 (0.000031) |
| 8 | 25 | 0.00032 (0.000013) | 8 | 12.8 | 0.000625 (0.000025) |
| 9 | 40 | 0.0002 (0.0000079) | 9 | 20 | 0.0004 (0.000016) |
| A | 50 | 0.00016 (0.0000063) | A | 25.6 | 0.0003125 (0.000012) |
| B | 80 | 0.0001 (0.0000039) | B | 40 | 0.0002 (0.0000079) |
| C | 100 | 0.00008 (0.0000031) | C | 50 | 0.00016 (0.0000063) |
| D | 125 | 0.000064 (0.0000025) | D | 51.2 | 0.00015625 (0.0000062) |
| E | 200 | 0.00004 (0.0000016) | E | 100 | 0.00008 (0.0000031) |
| F | 250 | 0.000032 (0.0000013) | F | 102.4 | 0.000078125 (0.0000031) |

## Notes:

- The resolutions are theoretical values.
- The resolution is calculated by dividing the base resolution by the number of microstep.
- The numbers of microsteps that can be specified by the "Resolution Select" signal are limited to those selected in resolution 1 or resolution 2.
- Do not change the "Resolution Select" signal input or resolution select switch while the actuator is operating. It may cause malfunction.


## - Connection Diagram



## $\diamond$ Input/Output Signal Connection

- Keep the input signal $V_{0}$ between 5 VDC and 24 VDC.

When $V_{0}$ is equal to 5 VDC , the external resistor $R_{1}$ is not necessary. When $V_{0}$ is above 5 VDC , connect $R_{1}$ to keep the current between 10 mA and 20 mA .
Example: When $V_{0}$ is $24 \mathrm{VDC} \quad \mathrm{R}_{1}: 1.5$ to $2.2 \mathrm{k} \Omega, 0.5 \mathrm{~W}$ or more

- Keep the output signal voltage $\mathrm{V}_{0}$ between 5 VDC and 24 VDC , current 10 mA or less. When $V_{0}$ is above 10 mA , connect $\mathrm{R}_{2}$ to keep the current 10 mA or less.


## $\diamond$ Power Supply

Use a power supply that can supply sufficient input current.
When power supply capacity is insufficient, a decrease in actuator output can cause the following malfunctions:

- Actuator does not move properly at high-speed (insufficient thrust).
- Slow actuator startup and stopping
$\diamond$ Connecting the Electromagnetic Brake to Power Supply
- Connect the red/white lead from the actuator to the +24 VDC terminal on the DC power supply and the black/white lead to the GND terminal. (The electromagnetic brake leads have polarity. The electromagnetic brake will not operate if the leads are connected in reverse polarity.)
- For the electromagnetic brake, use a power supply of $24 \mathrm{VDC} \pm 5 \%, 0.1 \mathrm{~A}$ or more for DRL42, or 24 VDC $\pm 5 \%, 0.3$ A or more for DRL60.
- To connect the electromagnetic brake to the DC power supply, use a shielded cable of AWG24 or thicker and keep the wiring distance to a minimum. Be sure to use the supplied surge suppressor to protect switch contact and suppress noise.


## $\diamond$ Notes on Wiring

- Use twisted-pair wires of AWG24 to 22 and 2 m ( 6.6 ft .) or less in length for the signal lines.
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. Technical reference $\rightarrow \mathrm{F}-67$
- Use wires of AWG22 for the power supply lines. When assembling the connector, use the hand-operated crimp tool or the crimped driver lead wire set (sold separately). The crimp tool is not provided with the package. It must be purchased separately.
- Signal lines should be kept at least 2 cm ( 0.79 in .) away from power lines (power supply lines and motor lines). Do not wire the signal lines with the power lines in the same duct or bundle them together.
- Extension of the motor leads should be within 10 m (32.8 ft.)
- If noise generated by the wiring and layout of motor cables and/or power cables causes a problem, try shielding the cables or insert ferrite cores.
- Incorrect connection of DC power input will lead to driver damage. Make sure that the polarity is correct before turning the power on.


## - Description of Input/Output Signals

Indication of Input/Output Signal "ON"'OFF"
Input (output) "ON" indicates that the current is sent into the photocoupler (transistor) inside the driver. Input (output)

Photocoupler OFF $\longdiv { O N }$
"OFF" indicates that the current is not sent into the
photocoupler (transistor) inside the driver.
Pulse (CW) and Rotation Direction (CCW) Input Signal $\diamond$ Input Circuit and Sample Connection


Notes:

- Keep the input signal voltage $\mathrm{V}_{0}$ between 5 VDC and 24 VDC.
- When $\mathrm{V}_{0}$ is equal to 5 VDC , the external resistor $R_{1}$ is not necessary. When $\mathrm{V}_{0}$ is above 5 VDC , connect $R_{1}$ to keep the current between 10 mA and 20 mA .
$\diamond$ Pulse Waveform Characteristics

* The shaded area indicates when the photocoupler diode is ON. The actuator moves when the photocoupler state changes from ON to OFF.
The minimum interval time when changing rotation direction $10 \mu \mathrm{~s}$ is shown as a response time of circuit. This value varies greatly depending on the actuator type and load inertia.


## $\diamond$ Pulse Input Mode

-1-Pulse Input Mode
The 1-pulse input mode uses "Pulse" and "Rotation Direction" signals. When the "Pulse" input is switched from ON to OFF while the "Rotation Direction" input is ON, the screw shaft moves one step forward. When the "Pulse" input is switched from ON to OFF while the "Rotation Direction" input is OFF, the screw shaft moves one step backward.


## - 2-Pulse Input Mode

The 2-pulse input mode uses "CW" and "CCW" pulse signals. When the "CW" input is switched from ON to OFF, the screw shaft moves one step forward. When the "CCW" input is switched from ON to OFF, the screw shaft moves one step backward.


All Windings Off (A.W.OFF)/Resolution Select (C/S)/ Automatic Current Cutback Release (C.D.INH) Input Signal
$\diamond$ Input Circuit and Sample Connection


Note:

- Keep the input signal voltage $\mathrm{V}_{0}$ between 5 VDC and 24 VDC . When $\mathrm{V}_{0}$ is equal to 5 VDC , the external resistor $R_{1}$ is not necessary. When $\mathrm{V}_{0}$ is above 5 VDC , connect $R_{1}$ to keep the current between 10 mA and 20 mA .
$\diamond$ All Windings Off (A.W.OFF) Input Signal Pin No.(5), (6)
- This signal is used when moving the screw shaft for manual positioning.
- When the "All Windings Off" input is turned "ON," the motor current turns off and the actuator loses its holding torque.
- When the "All Windings Off" input is turned "OFF," the motor current turns on and the actuator regains its holding torque.


Note:

- When operating the actuator, this switch must be "OFF."
$\diamond$ Resolution Select (C/S) Input Signal Pin No. (7, (8)
- This signal is used to switch between two resolutions set by resolution setting switch (DATA1, DATA2). When the "Resolution Select" input is in the "photocoupler OFF" state, the resolution set by resolution setting switch DATA1 is selected. When the "Resolution Select" input is in the "photocoupler ON" state, the resolution set by resolution setting switch DATA2 is selected.
Example: Changing the resolution from $0.0004 \mathrm{~mm}(0.000016 \mathrm{in}$.)
( 10 mic rosteps $/ \mathrm{step}$ ) to 0.004 mm ( 0.00016 in .)
(1 microsteps/step) (DRL42P)

$\diamond$ Automatic Current Cutback Release (C.D.INH) Input Signal Pin No.(9), (10)
- Turning the "Automatic Current Cutback Release" input "ON" will disable the automatic current cutback function when the actuator is at standstill. Turning the "Automatic Current Cutback Release" input "OFF" will enable the automatic current cutback function. When the automatic current cutback function is enabled, the output current to the motor will be automatically reduced within approximately 0.1 second after the pulse input is stopped, thus suppressing heat generation from the motor and driver.

Excitation Timing (TIM.) Output Signal
$\diamond$ Output Circuit and Sample Connection


Note:

- Keep the output signal voltage $\mathrm{V}_{0}$ between 5 VDC and 24 VDC , current 10 mA or less. When $\mathrm{V}_{0}$ is above 10 mA , connect the external resistor $\mathrm{R}_{2}$ as shown in the figure to keep the current 10 mA or less.

This signal is used for precise home detection, etc.
The "Excitation Timing" output comes on every particular amount (see the chart below) of the screw shaft movement.

| Model | Travel Amount of the Screw Shaft |
| :---: | :---: |
| DRL20, DRL28P | 0.02 mm (0.00079 in.) |
| DRL42P | 0.04 mm (0.0016 in.) |
| DRL60P | 0.08 mm (0.0031 in.) |
| DRL28M | 0.01 mm (0.00039 in.) |
| DRL42M | 0.02 mm (0.00079 in.) |
| DRL60M | 0.04 mm (0.0016 in.) |
| Movement of the Screw | Forward Stop Backward Stop |
|  |  |
|  |  |

## - Timing Chart



[^0]
[^0]:    * 1 The minimum switching time to change rotation direction (1-pulse input mode), and switching time to change CW, CCW pulse (2-pulse input mode) $10 \mu \mathrm{~s}$ is shown as a response time of circuit. The actuator may need more time.
    *2 Depends on load inertia, load torque and starting frequency.
    *3 Never input a pulse signal immediately after switching the "All Windings Off" signal to the "photocoupler OFF" state. The actuator may not start.
    * 4 Wait at least five seconds before turning on the power again.
    *5 Only for electromagnetic brake type

