■ Connection and Operation

Power supply terminal block

Motor connector
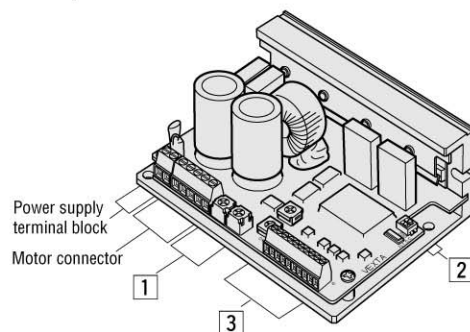
① Current Adjustment Potentiometers

| Indicator	Switch Name	Functions
RUN	Motor run current potentiometer	Adjusts the motor running current
STOP	Motor stop current potentiometer	Adjusts the current at the motor standstill

② Function Select Switches

Indicator	Switch Name	Functions
2P/1P	Pulse input mode switch	Switches between 1-pulse input and 2-pulse input
C.C./OFF	DC check switch	Used when adjusting the motor's running current. When running the motor, always have this switch set to OFF. The factory setting is OFF.

③ Input/Output Signals

Indicator	Input/Output	Terminal No.	Signal Name
TB3	Input signal	1	Pulse Signal (CW Pulse Signal)
		2	
		3	Rotation Direction Signal (CCW Pulse Signal)
		4	
		5	All Windings Off Signal
		6	
	Output signal	7	Excitation Timing Signal
		8	
	Input signal	9	Step Angle Select Signal
		10	

● Connection Diagrams
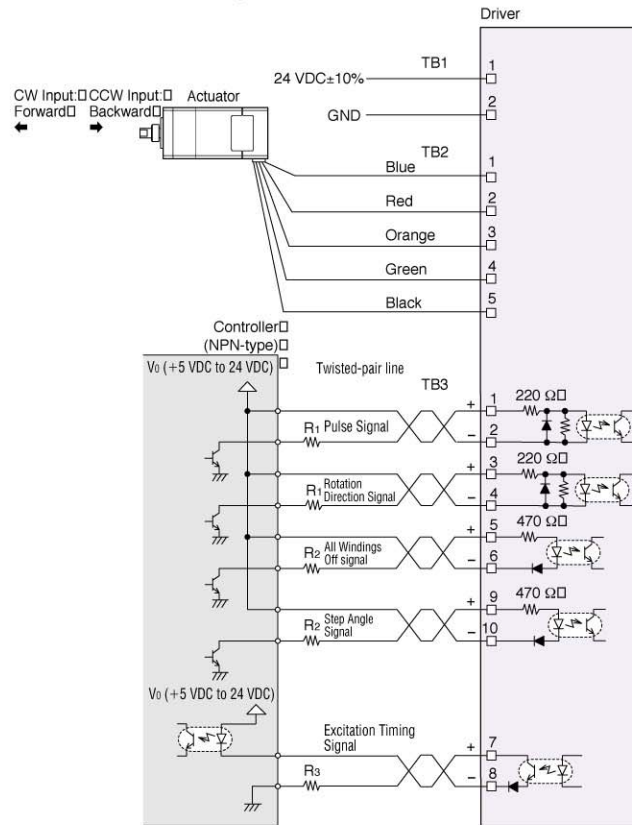
Notes:
- Keep the input signal voltage Vo between 5 VDC and 24 VDC.
  When Vo is equal to 5 VDC, the external resistances R_1 and R_2 are not necessary. When Vo is above 5 VDC, connect R_1 and R_2 to keep the current as follows:
  Pulse, Rotation Direction: 10 mA to 20 mA max.
  All Windings OFF, Step Angle Select: 10 mA to 15 mA max.
- Keep the output signal voltage Vo between 5 VDC and 24 VDC.
  When Vo is equal to 5 VDC, the external resistance R_3 is not necessary. When Vo is above 5 VDC, connect R_3 to keep the current below 10 mA max.
- Use twisted-pair wire of AWG 24 to AWG 22 and 6.6 feet (2 m) or less in length for the signal line.
- Suitable wire size for the TB1, TB2 and TB3 terminal block is between AWG20 and 26. Use AWG 20 for power supply lines.
- Use spot grounding to ground the driver and external controller.
- Signal lines should be kept at least 3.94 inches (10 cm) away from power lines (power supply lines and motor lines). Do not bind the signal line and power line together.
- If noise generated by the motor lead wires cause a problem, try shielding the motor lead wires with conductive tape or wire mesh.
- 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

Pulse Input and Rotation Direction Input

1-Pulse Input Mode
Pulse Signal

"Pulse" signal is input to the Pulse − terminal. When the photocoupler state changes from "ON" to "OFF", the screw shaft moves one step. The output direction of a screw shaft is determined by the rotation direction signal.

Rotation Direction Input

The "Rotation Direction" signal is input to the D/CCW − terminal. A "photocoupler ON" signal input commands the screw shaft to move forward. A "photocoupler OFF" signal input commands the screw shaft to move backward.

2-Pulse Input Mode
CW Pulse Signal

"Pulse" signal is input to the P/CW − terminal. When the photocoupler state changes from "ON" to "OFF", the screw shaft moves one step forward.

CCW Pulse Signal

"Pulse" signal is input to the D/CCW − terminal. When the photocoupler state changes from "ON" to "OFF", the screw shaft moves one step backward.

All Windings Off (A.W. OFF) Input

When the "All Windings Off" (A.W. OFF) signal is in the "photocoupler ON" state, the current to the motor is cut off and motor torque is reduced to zero.
This signal is used when moving the motor by external force or manual home positioning.

Step Angle Select (C/S) Input

When the "Step Angle Select" signal is in the "photocoupler OFF" state, the step angle set by step resolution select switch DATA1 is selected. When the "Step Angle Select" signal is in the "photocoupler ON" state, the step angle set by step resolution select switch DATA2 is selected.
This signal can be used to change the motor speed or amount of rotation without altering the input pulses.

Excitation Timing (TIMING) Output

When the motor-excitation state is in the excitation home position (step [0]), the driver switches on the timing output. The motor-excitation state is reset to the excitation home position when the power supply is switched on. The timing output comes on every particular amount (see the chart below) of the screw shaft movement, being synchronized with the pulse input. When the pulse signals are input at an integer multiple of the number of pulses required for the screw shaft to move this particular amount (see the chart below), it is possible to check whether or not the driver is operating normally by monitoring the timing output.

Model	Movement Distance of the Screw Shaft [inch (mm)]
DRL28	0.00079 (0.02)
DRL42	0.0016 (0.04)
DRL60	0.0031 (0.08)

Notes:
- When using the timing output, stop the motor's output shaft at an integer multiple of a particular amount (see the chart above).
- When switching the step angle using the C/S (step-angle switch) input, do this with the motor stopped and the timing output on.

● Step Angle Selection

The motor speed and step distance can be changed without changing the input pulse frequency by switching the step angle switch. The step angle is set with step angle setting switches DATA1 and DATA2. DATA1 and DATA2 each have 16 settings from which one step angle each can be selected. The step angles that can be set are shown in the table below.

DATA1 and DATA2 are set to the scale corresponding to the step angle selected for each.

The step angle is changed with the step angle select signals.
Photocoupler "ON": The step angle set with DATA1 is selected.
Photocoupler "OFF": The step angle set with DATA2 is selected.

Resolution Setting Switches DATA1/DATA2	Number of Divisions	Actuator's Resolution [inch (mm)]		
		DRL28	DRL42	DRL60
0	1	0.000079 (0.002)	0.00016 (0.004)	0.00031 (0.008)
1	2	0.000039 (0.001)	0.000079 (0.002)	0.00016 (0.004)
2	2.5	0.000031 (0.0008)	0.000063 (0.0016)	0.00013 (0.0032)
3	4	0.00002 (0.0005)	0.000039 (0.001)	0.000079 (0.002)
4	5	0.000016 (0.0004)	0.000031 (0.0008)	0.000063 (0.0016)
5	8	0.0000098 (0.00025)	0.00002 (0.0005)	0.000039 (0.001)
6	10	0.0000079 (0.0002)	0.000016 (0.0004)	0.000031 (0.0008)
7	20	0.0000039 (0.0001)	0.0000079 (0.0002)	0.000016 (0.0004)
8	25	0.0000031 (0.00008)	0.0000063 (0.00016)	0.000013 (0.00032)
9	40	0.000002 (0.00005)	0.0000039 (0.0001)	0.0000079 (0.0002)
A	50	0.0000016 (0.00004)	0.0000031 (0.00008)	0.0000063 (0.00016)
B	80	0.00000098 (0.000025)	0.000002 (0.00005)	0.0000039 (0.0001)
C	100	0.00000079 (0.00002)	0.0000016 (0.00004)	0.0000031 (0.00008)
D	125	0.00000063 (0.000016)	0.0000013 (0.000032)	0.0000025 (0.000064)
E	200	0.00000039 (0.00001)	0.00000079 (0.00002)	0.0000016 (0.00004)
F	250	0.00000031 (0.000008)	0.00000063 (0.000016)	0.0000013 (0.000032)

● Timing Chart

The shaded section indicates that the photocoupler is on.
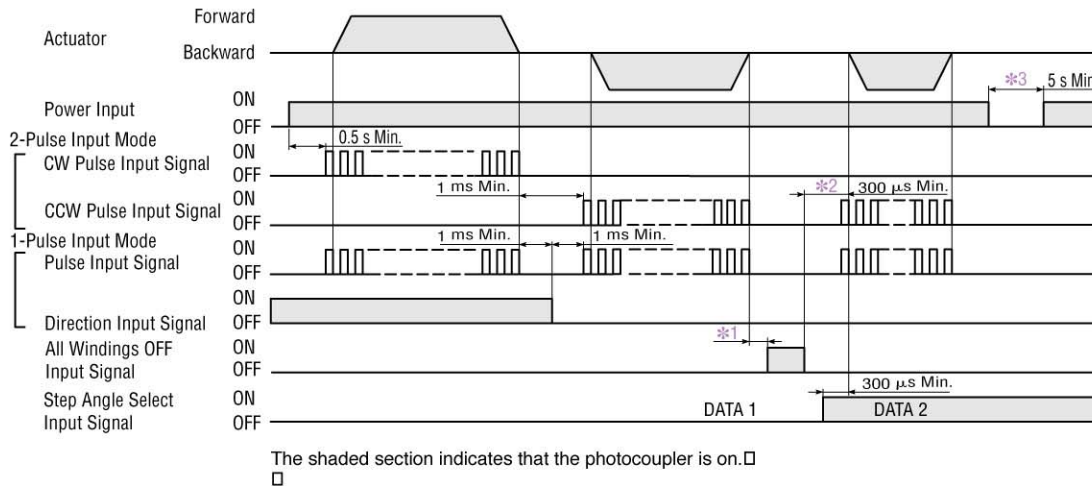
*1 Depends on load Inertia, load torque, and starting frequency.
*2 Never input a step pulse signal immediately after switching the "All Winding Off" signal to the off state. The actuator may not start.
*3 Wait at least 5 seconds before turning on the power.

■ Adjusting the Current
● Adjusting the Motor Current
Use the "RUN" potentiometer to decrease the current and suppress the temperature rise in the motor/driver, or when there is sufficient motor torque and you want to suppress vibration by lowering the current.

Use the "STOP" potentiometer to readjust the current at motor standstill in relation to the holding-brake force.
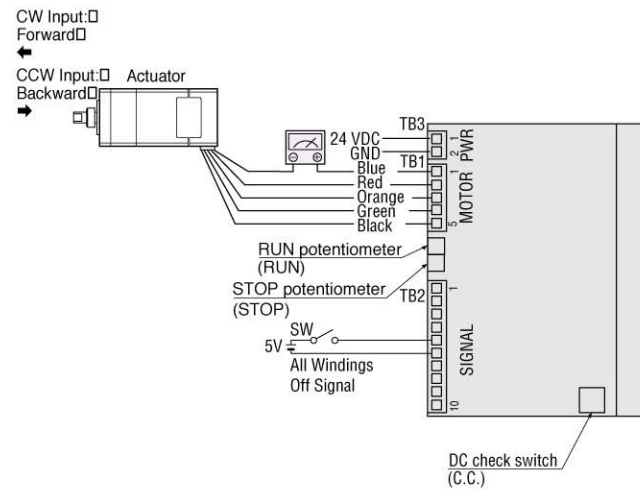
Factory Settings
Running current:　　　　　Rated current
Current at motor standstill: Approx. 50% of rated current
Follow the procedure below to adjust the motor current.

1 Connecting an Ammeter
Connect a DC ammeter as illustrated below.

Connect an ammeter between pin ① of TB2 connector and the actuator. Set all driver input signals to the "photocoupler OFF" state.

Note:
● Do not input pulse signals.

2 Adjusting the Motor Running Current
To adjust the motor running current, follow the procedure below:
1. Set the current-checking switch to the "photocoupler ON" state. Keep other signals in the "photocoupler OFF" state.
2. Turn on the power to the driver.
3. Use the "RUN" potentiometer to adjust the motor's running current.
4. When the power is turned on, the value measured by the ammeter represents the total current in two phases through the blue motor lead wire. The current for one phase is equivalent to one-half the ammeter value. (Example: To set the current to 1.0 A/phase, adjust the current level until the ammeter reads 2.0 A.)
5. When the running current has been adjusted, set the current-checking switch back to the "photocoupler OFF" state.

Notes:
● Be sure to use the motor at the rated current or below.
● Adjusting the running current will also change the current at standstill.

3 Adjusting the Current at Motor Standstill
To adjust the current at motor standstill, follow the procedure below:
1. Set the current-checking switch to the "photocoupler OFF" state. Keep other signals in the "photocoupler OFF" state.
2. Turn on the power to the driver.
3. Use the "STOP" potentiometer to adjust the motor's running current.
4. When the power is turned on, the value measured by the ammeter represents the total current in two phases through the blue motor lead wire. The current for one phase is equivalent to one-half the ammeter value. (Example: To set the current to 1.0 A/phase, adjust the current level until the ammeter reads 2.0 A.)

$$\text{Holding Torque [oz-in (N·m)]} = \frac{\text{Maximum Holding Torque [oz-in (N·m)]} \times \text{Current at Standstill [A]}}{\text{Motor rated current [A]}}$$

Notes:
● Always set the running current first, turn off the driver power and turn it back on, and then set the current at standstill. Setting the running current after current at standstill may change the current setting at standstill.
● Setting the current at motor standstill too low may affect the starting of the actuator or the position-holding action.

■ List of Actuator and Driver Combinations
● Standard Type

Package Model	Actuator Model	Driver Model
DRL28PA1-03D	DRL28PA1-03	DFC5107T
DRL28PB1-03D	DRL28PB1-03	DFC5107T
DRL42PA2-04D	DRL42PA2-04	DFC5107T
DRL42PB2-04D	DRL42PB2-04	DFC5107T
DRL60PA4-05D	DRL60PA4-05	DFC5114T

● Guide Type

Package Model	Actuator Model	Driver Model
DRL28PA1G-03D	DRL28PA1G-03	DFC5107T
DRL28PB1G-03D	DRL28PB1G-03	DFC5107T
DRL42PA2G-04D	DRL42PA2G-04	DFC5107T
DRL42PB2G-04D	DRL42PB2G-04	DFC5107T
DRL60PA4G-05D	DRL60PA4G-05	DFC5114T