ACTIVAL™
Motorized Two-way Valve with Flanged-end Connection (PN16 / GG-20) for High Differential Pressure Application

■ Overview

ACTIVAL™ Model VY51_9J for high differential pressure application is a series of motorized two-way valves with flanged-end connection. Rotary valve and actuator are integrated in a single unit.

Valve size ranges from DN15 (1/2") to DN150 (6"), and valve body rating corresponds to ISO PN16.

Actuator has a reversible synchronous motor, which operates at a low voltage of 24 V AC.

5 kinds of control signals are available to operate ACTIVAL.

1. Built-in 135 Ω feedback potentiometer:
   Provides proportional control in combination with a DDC controller, including Infilex™ GC (Model WY5111).
2. Nominal 135 Ω resistance input:
   Provides proportional control in combination with a proportionally controlled electric controller, including Neostat™ (Model TY900_Z/TY9800).
3. 4-20 mA DC input:
   Provides proportional control in combination with a direct digital controller (DDC), including Infilex™ GC (Model WY5111) and Model R35/R36.
4. 2-10 V DC input:
   Provides proportional control in combination with a DDC controller, including Infilex™ AC (Model WY5117).
5. 0-10 V DC input
   Provides proportional control in combination with a DDC controller.

ISO: International Organization for Standardization
DDC: Direct Digital Control

■ Features

- Applicable to high differential pressure applications:
  Water flow is controlled inside the valve to prevent over pressure drop, ensuring cavitation erosion resistance. (See Fig. 1.)
- Compact and lightweight:
  Rotary motor actualizes small body and light weight.
- Valve and actuator integrated in a single unit:
  Pre-assembled body requires no adjustment.
- A variety of control signals available:
  - Nominal 135 Ω feedback potentiometer
  - Nominal 135 Ω resistance input
  - 4-20 mA DC input
  - 2-10 V DC input
  - 0-10 V DC input
- Valve applicable to high differential pressure, high Cv value, wide rangeability, and low leakage
- Durable actuator with low power consumption
- Modified linear flow characteristics
- 2-10 V DC output (for position feedback) available with 4-20 mA DC input type and 2-10 V DC input type and 0-10 V DC input type.

* Although our company name changed from Yamatake Corporation to Azbil Corporation on April 1, 2012, our former logo remains on this product.

Safety Precautions

Please read instructions carefully and use the product as specified in this manual. Be sure to keep this manual nearby for quick reference.

Restrictions on Use

This product was developed, designed, and manufactured for general air conditioning use.

Do not use the product in a situation where human life may be at risk or for nuclear applications in radiation controlled areas. If you wish to use the product in a radiation controlled area, please contact Azbil Corporation.

Particularly when the product is used in the following applications where safety is required, implementation of fail-safe design, redundant design, regular maintenance, etc., should be considered in order to use the product safely and reliably.

- Safety devices for protecting the human body
- Start/stop control devices for transportation machines
- Aeronautical/aerospace machines

For system design, application design, instructions for use, or product applications, please contact Azbil Corporation.

Azbil Corporation bears no responsibility for any result, or lack of result, deriving from the customer's use of the product.

■ Warnings and Cautions

⚠ WARNING	Alerts users that improper handling may cause death or serious injury.
⚠ CAUTION	Alerts users that improper handling may cause minor injury or material loss.

■ Signs

	Alerts users possible hazardous conditions caused by erroneous operation or erroneous use. The symbol inside △ indicates the specific type of danger. (For example, the sign on the left warns of the risk of electric shock.)
	Notifies users that specific actions are prohibited to prevent possible danger. The symbol inside ⃠ graphically indicates the prohibited action. (For example, the sign on the left notifies that disassembly is prohibited.)
	Instructs users to carry out a specific obligatory action to prevent possible danger. The symbol inside ● graphically indicates the actual action to be carried out. (For example, the sign on the left indicates general instructions.)

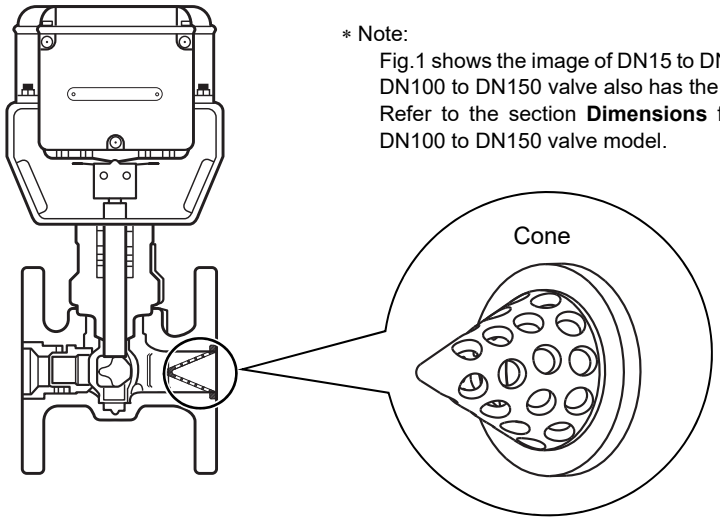
⚠ WARNING	
	When handling or transporting any heavy product (more than 18 kg), carefully move the product with a hand truck or the like, or with 2 or more people. Careless lifting or accidental dropping of the product may result in injury or product damage.

⚠ CAUTION	
	Provide a circuit protector (e.g., a fuse or circuit breaker) for the power source. Failure to do so may cause a short circuit leading to fire or device failure.
	Do not freeze this product. Doing so may damage the valve body and cause leakage.
	When piping this product, be sure there is no foreign matter in the pipes. If foreign matter remains in the pipes, the product may break down.
	Install, wire, and use this product under the conditions specified by this manual. Failure to do so may cause fire or device failure.
	When installing this product, hold it in the proper position and securely fasten it to the pipes. Excessive tightening or improper installation position may damage the valve.
	After installation, make sure no fluid leaks from the valve-pipe connections. Improper piping may cause fluid leakage outside of the valve.
	Do not put a load or weight on this product. Doing so may damage the product.
	Installation and wiring of the actuator must be performed by personnel qualified to do instrumentation and electrical work. Mistakes in installation or wiring may cause fire or electric shock.
	Before wiring, setting, maintenance, or replacement, be sure to turn off the power to this product. Failure to do so may result in electric shock or device failure.
	All wiring must comply with applicable codes and ordinances. Otherwise there is a danger of fire.
	Use crimp terminals with insulation for connections to the product terminals. Failure to do so may cause short circuit leading to fire or device failure.
	Tighten the terminal screws with the specified torque. Insufficient tightening of the terminal screws may cause fire or overheating.
	After wiring, setting, engineering, maintenance, or replacement work, be sure to reattach the cover. Failure to do so may result in electric shock.
	Do not carelessly touch this product when it is used to control hot water. Doing so may result in burns, because the product reaches a high temperature.

IMPORTANT:

To control ACTIVAL with a third party controller, please consult with Azbil Corporation's sales personnel.

■ Mechanism of Cavitation Erosion Resistance



∗ Note:
Fig.1 shows the image of DN15 to DN80 valve model.
DN100 to DN150 valve also has the cone as well.
Refer to the section **Dimensions** for the image of DN100 to DN150 valve model.

Figure 1. Mechanism of cavitation erosion resistance

■ Model Numbers

Model VY51_9J0_ _ _ is the model for the valve and actuator integrated into a single unit.
The model number label is attached to the yoke. The control signal is indicated on the actuator label and on the wiring diagram as follows:

- Nominal 135 Ω feedback potentiometer: F.B. Pot
- Nominal 135 Ω resistance input: 135 Ω
- 4-20 mA DC input: 4-20 mA
- 2-10 V DC input: 2-10 V
- 0-10 V DC input: 0-10 V

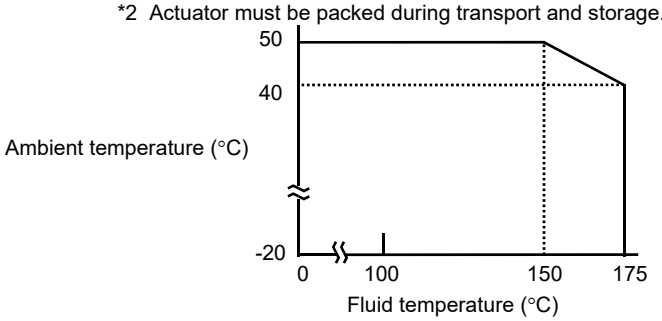
Base model number	Actuator/valve		Actuator		Valve	Description
	Control signal	Rating/ material	Type	—	Nominal size / Cv	
VY51						Motorized two-way valve with flanged-end connection
	1					Nominal 135 Ω feedback potentiometer
	2					Nominal 135 Ω resistance input
	3					4 mA DC to 20 mA DC input with 2 V DC to 10 V DC feedback output
	4					2 V DC to 10 V DC input with 2 V DC to 10 V DC feedback output
	5					0 V DC to 10 V DC input with 2 V DC to 10 V DC position feedback output
		9				PN16 / GG-20 with cavitation erosion resistant mechanism
			J			IEC IP54 protected and standard torque type actuator with terminal block for DN15 to DN125 valve IEC IP54 protected and high torque type actuator with terminal block for DN150 valve
				0		—
					012	DN15 (1/2”) / 2.5 in Cv value
					020	DN25 (1”) / 6.8 in Cv value
					021	DN25 (1”) / 10 in Cv value
					040	DN40 ($1^1/_2$”) / 16 in Cv value
					041	DN40 ($1^1/_2$”) / 25 in Cv value
					050	DN50 (2”) / 40 in Cv value
					060	DN65 ($2^1/_2$”) / 65 in Cv value
					080	DN80 (3”) / 95 in Cv value
					101	DN100 (4”) / 145 in Cv value
					121	DN125 (5”) / 234 in Cv value
					151	DN150 (6”) / 350 in Cv value

IEC: International Electrotechnical Commission

■ Specifications

For weight, refer to the table shown in the section **Dimensions**.

● Valve and actuator (as a single unit) specifications

Item		Specification		
Environmental conditions		Rated operating condition	Limit operating condition	Transport/storage conditions (packaged*2)
	Ambient temperature*1	-20 °C to 50 °C (Fluid temperature 0 °C to 150 °C) -20 °C to 40 °C (Fluid temperature 150 °C to 175 °C)	-20 °C to 60 °C	-20 °C to 70 °C
	Ambient humidity	5 %RH to 95 %RH		
	Vibration	4.9 m/s^2 (10 Hz to 150 Hz)	9.8 m/s^2 (10 Hz to 150 Hz)	19.6 m/s^2 (10 Hz to 150 Hz)
		Notes: *1 Do not allow the fluid to freeze. *2 Actuator must be packed during transport and storage. 		
Installation locations		Indoor / outdoor (Keep away from direct sunlight.) Note: Salt air, corrosive gas, flammable gas, and organic solvent must be avoided.		
Installation orientation		Installable in any position ranging from upright to sideways (90° tilted.) * Always install in upright position outdoors.		
Position for shipment		100 % (fully open) preset at factory.		

● Valve specifications

Item	Specification			
Model	Two-way valve with flanged-end connection (raised face flange), proportional control			
Body pressure rating	PN16 (Max. working pressure: 1.6 MPa)			
Size, Cv, close-off rating	Model number	Nominal size	Cv	Close-off ratings
	VY51_9J0012	DN15 (1/2")	2.5	1.0 MPa
	VY51_9J0020	DN25 (1")	6.8	1.0 MPa
	VY51_9J0021	DN25 (1")	10	1.0 MPa
	VY51_9J0040	DN40 (1 1/2")	16	1.0 MPa
	VY51_9J0041	DN40 (1 1/2")	25	1.0 MPa
	VY51_9J0050	DN50 (2")	40	1.0 MPa
	VY51_9J0060	DN65 (2 1/2")	65	1.0 MPa
	VY51_9J0080	DN80 (3")	95	1.0 MPa
	VY51_9J0101	DN100 (4")	145	0.5 MPa
	VY51_9J0121	DN125 (5")	234	0.5 MPa
	VY51_9J0151	DN150 (6")	350	0.5 MPa
End connection	PN16 flanged-end (equivalent to ISO 7005-2: 1988)			
Applicable fluid	Chilled/hot water, high-temperature water, brine (ethylene glycol solutions, 50 % max.)			
Allowable fluid temperature	0 °C to 175 °C for DN15 to DN80 valves, 0 °C to 130 °C for DN100 to DN150 valves (No freezing)			
Flow characteristics	Modified linear characteristic			
Rangeability	100 : 1			
Seat leakage	0.01 % or less of rated Cv value (0.0006 Cv or less for DN15 models)			
Materials	Body	Gray cast iron (GG-20)		
	Plug, stem	Stainless steel		
	Cone	DN15 to DN80 valves: Stainless steel DN100 to DN150 valves: Cast iron		
	Seat ring	Heat-resistant PTFE		
	Gland packing	Inorganic fiber		
	Gasket	Expandable graphite sheet		
Paint	Gray (equivalent to Munsell 5B 4/1)			
Actuator to be combined	Integrated with the valve			

● Actuator specifications

Item		Specification	
Power supply		24 V AC ± 15 %, 50 Hz/60 Hz	
Applicable valve size	Standard torque type	DN15 to DN125	
	High torque type	DN150	
Power consumption	Standard torque type	Model VY5119J: 7 VA Model VY5129J / VY5139J / VY5149J / VY5159J: 8 VA	
	High torque type	Model VY5119J: 9 VA Model VY5129J / VY5139J / VY5149J / VY5159J: 10 VA	
Timing		63 ± 5 sec (50 Hz) / 53 ± 5 sec (60 Hz)	
Control signal input		- Nominal 135 Ω feedback potentiometer (Total resistance: Nominal 135 Ω, Max. applied voltage: 5 V DC) - Nominal 135 Ω resistance input - 4 mA DC to 20 mA DC input (Input impedance: 100 Ω) ∗ Input impedance fluctuates depending on temperature and other environmental conditions. Therefore, a controller with 200 Ω or higher allowable load resistance is recommended. - 2 V DC to 10 V DC input (Input impedance: 150 kΩ or higher) ∗ A controller with 100 kΩ or lower allowable load resistance is recommended. - 0 V DC to 10 V DC input (Input impedance: 150 kΩ or higher) ∗ A controller with 100 kΩ or lower allowable load resistance is recommended.	
Feedback signal output (only with 4-20 mA DC input, 2-10 V DC input, 0-10 V DC input types)		Range: 2 V DC (0 % position) to 10 V DC (100 % position) Max. load resistance: 10 kΩ or higher (Max. 1 mA)	
Valve position indication		Pointer located at the bottom of the actuator shows the position by pointing at the value (0: close to 100: open) of the scale on front, rear, and bottom sides.	
Wire connection		M3.5 screw terminal connection	
Enclosure rating		IEC IP54 (dust-proof and splash-proof)	
Insulation resistance		Between terminal and case: 5 MΩ or higher at 500 V DC	
Dielectric strength		Between terminal and case: 500 V AC/min with 5 mA or less leakage current	
Preset position for shipment		100 % (fully open)	
Materials		Case	Cast aluminum alloy
		Top cover, terminal cover	Polycarbonate resin (Color: gray)
		Yoke	Steel plate
Surface finishing		Case	None
		Yoke	Electro-galvanized (Bright chromate finish)

● Options

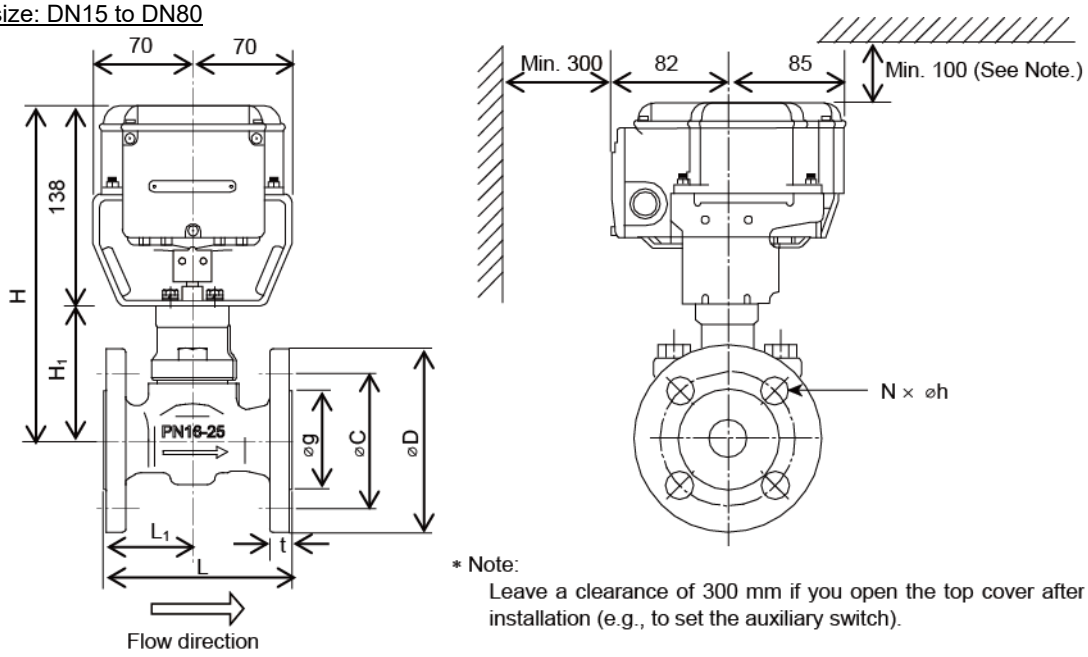
For options, separate order is required.

Item	Specification
Seal connector (Part No. 83104346-003)	Applicable wire size: ⌀7 mm to ⌀9 mm (Seal connector is necessary for IEC IP54 protection)
Auxiliary switch*1 (Part No. 83174063-101)	Number of switches: 2 (SW A and SW B) Max. applied voltage/current: 30 V DC / 100 mA*2 DC (Inductive load includes inrush current.) Actuating position SW A: Adjustable between 0 % (fully closed) and 100 % (fully open) SW B: Adjustable between 0 % (fully closed) and 100 % (fully open)
Auxiliary potentiometer*1 (Part No. 83165275-001)	Number of potentiometer: 1 Total resistance: Nominal 1 kΩ Actuating position: 0 % (fully closed) and 100 % (fully open) Max. applied voltage: 5 V DC

Note:
*1 Either the auxiliary switch or auxiliary potentiometer can be added, but not both.
*2 If the applied current exceeds 100 mA, please contact Azbil Corporation.

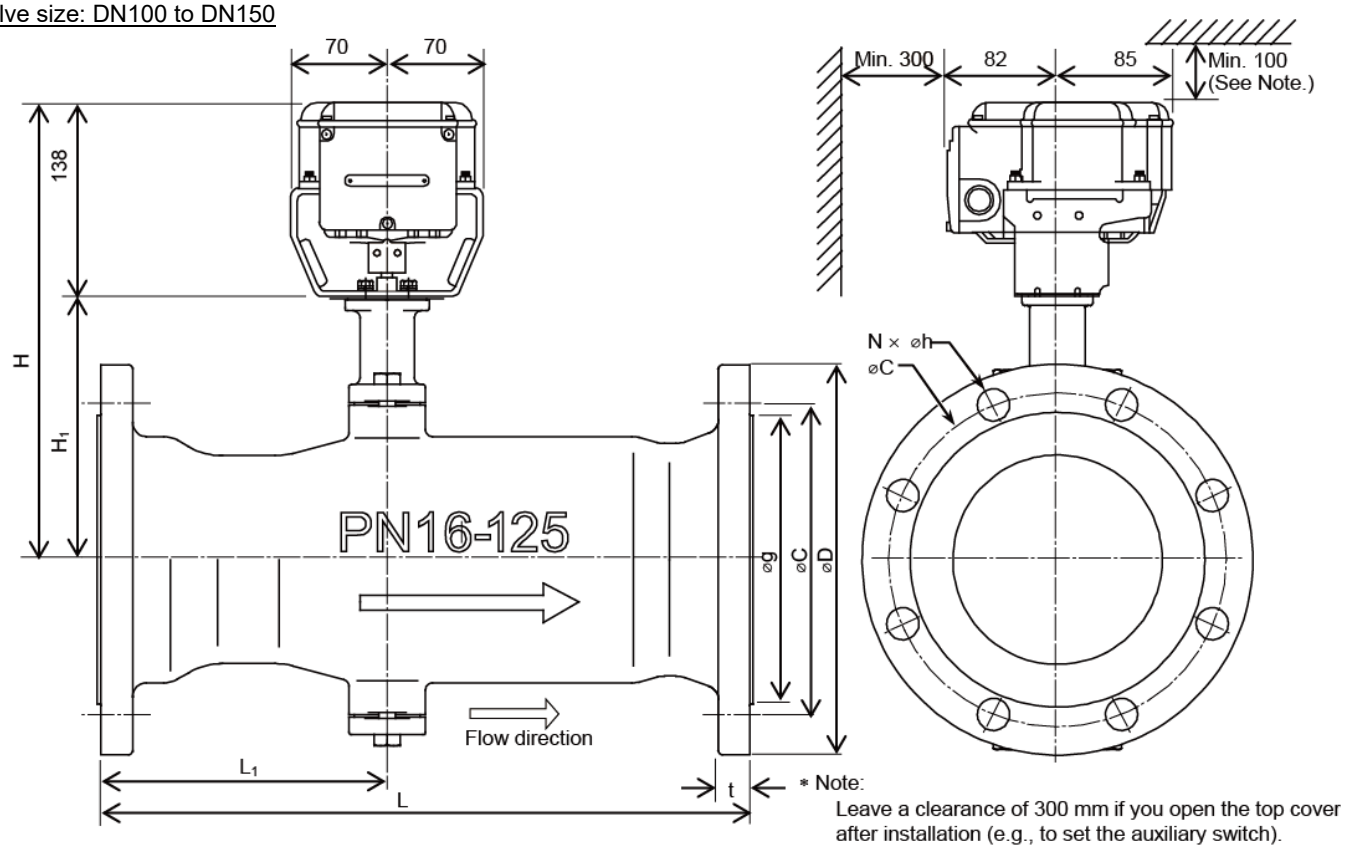
■ Dimensions and Maintenance Clearance

Valve size: DN15 to DN80



* Note:
Leave a clearance of 300 mm if you open the top cover after installation (e.g., to set the auxiliary switch).

Valve size: DN100 to DN150



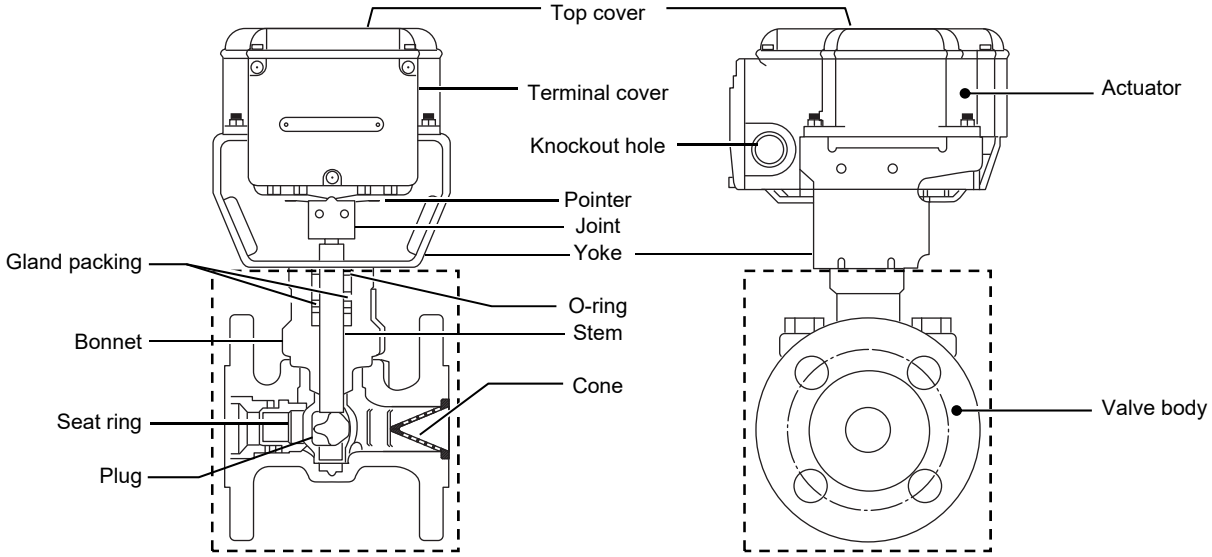
* Note:
Leave a clearance of 300 mm if you open the top cover after installation (e.g., to set the auxiliary switch).

Model number	Valve size (DN)	H	H_1	L	L_1	t	øg	øC	øD	øh	N	Weight (kg)
VY51_9J0012	15	213	75	108	50	16	46	65	95	14	4	4.6
VY51_9J002_	25	228	90	127	60	18	65	85	115	14	4	6.6
VY51_9J004_	40	241	103	165	82.5	20	84	110	150	19	4	10
VY51_9J0050	50	245	107	178	89	20	99	125	165	19	4	11.5
VY51_9J0060	65	262	124	190	90	22	118	145	185	19	4	16
VY51_9J0080	80	263	125	203	100	22	132	160	200	19	8	18.5
VY51_9J0101	100	283	145	350	163	24	156	180	220	19	8	28
VY51_9J0121	125	309.5	171.5	400	169	26	184	210	250	23	8	37
VY51_9J0151	150	318	180	480	212	26	211	240	285	23	8	49

Figure 2. Dimensions and maintenance clearance (mm)

■ Parts Indication

Valve size: DN15 to DN80



Valve size: DN100 to DN150

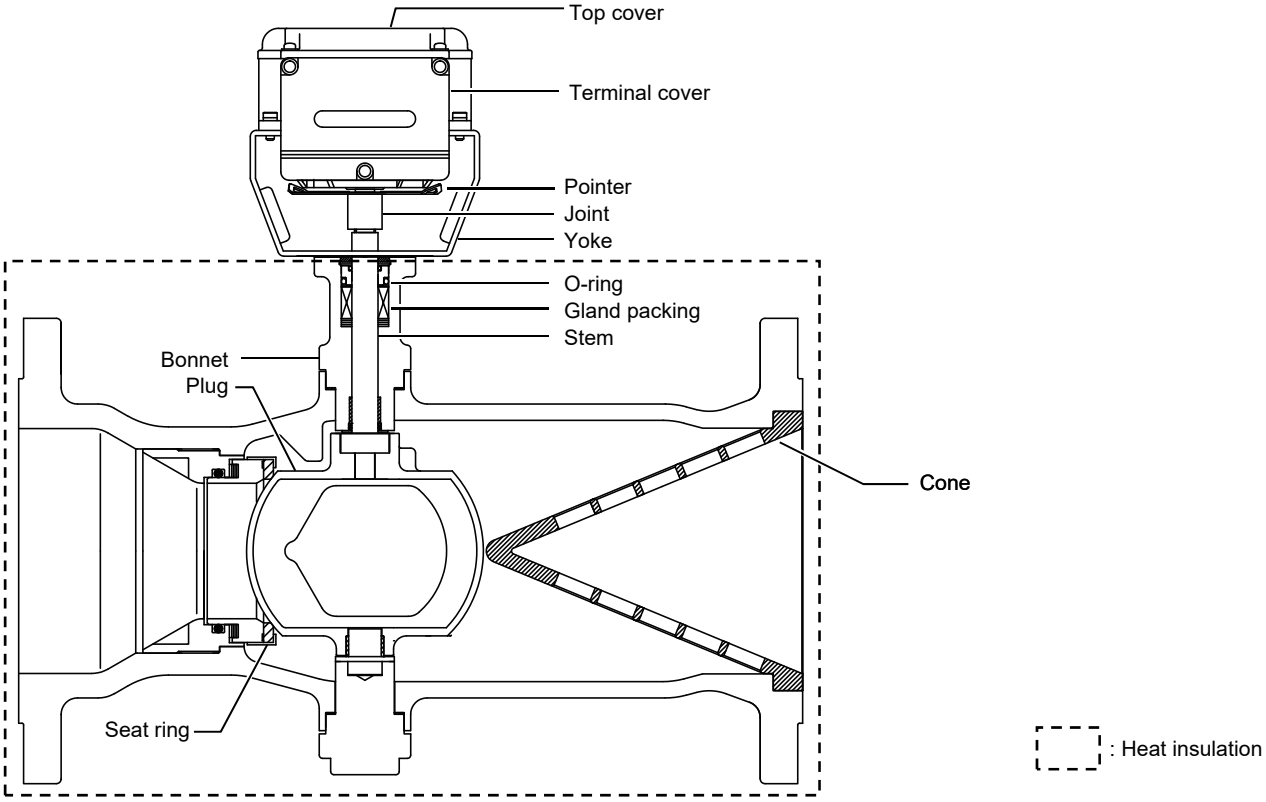


Figure 3. Parts identification

■ Recommended Criteria to Prevent Cavitation Erosion

Cavitation erosion is likely to occur in the case that the pressure ratio X_F calculated by the following formula overreaches the criterion value.

$$X_F = \frac{P_1 - P_2}{P_1 - Pv}$$

X_F: Pressure ratio
P_1: Absolute pressure of valve inlet [kPa (abs)]
P_2: Absolute pressure of valve outlet [kPa (abs)]
Pv: Saturated vapor pressure of fluid* [kPa (abs)]

* Saturated vapor pressure of fluid varies depending on the fluid temperature.

● **Always keep the pressure ratio X_F < 0.7 (criterion value).**

If the pressure ratio does not meet this criterion, cavitation erosion may occur. This value is thus necessary to prevent cavitation erosion. Note that cavitation itself may be generated even if the pressure ratio is kept below 0.7.

In addition to the pressure ratio, the flow velocity at the valve in 100 % position is another criterion for cavitation erosion.

$$\text{Flow velocity [m/s]} = 21.22 \times \frac{Q}{d^2}$$

Q = Flow rate [liter/min]
d = Valve size [DN (mm)]

Always keep the flow velocity < 7.0 m/s (criterion value) for chilled water and < 5.0 m/s (criterion value) for hot water.
If the flow velocity does not meet these criteria, cavitation erosion may occur.

■ Installation

⚠ WARNING
When handling or transporting any heavy product (more than 18 kg), carefully move the product with a hand truck or the like, or with 2 or more people. Careless lifting or accidental dropping of the product may result in injury or product damage.

⚠ CAUTION
Do not freeze this product. Doing so may damage the valve body and cause leakage.
When piping this product, be sure there is no foreign matter in the pipes. If foreign matter remains in the pipes, the product may break down.
Install, wire, and use this product under the conditions specified by this manual. Failure to do so may cause fire or device failure.
Installation and wiring of the actuator must be performed by personnel qualified to do instrumentation and electrical work. Mistakes in installation or wiring may cause fire or electric shock.

● Precautions for installation

- ACTIVAL Model VY51_9J is the valve and actuator integrated into a single unit. Do not combine the valve with any other actuator, or do not combine the actuator with any other valve.
- To remove foreign substances inside the pipes, install a strainer (with 40 or more meshes) on the inflow side of each valve. In a case that the strainers cannot be installed on the inflow side of each valve, install it on the pipe diverting sections (sections diverting from main piping system to sub piping system).
- Install the valve so that the flow direction of process fluid agrees with the arrow indicated on the valve body.
- After installation, remove buffer material wrapped around the valve (DN100 to DN150 models).

● Installation location

IMPORTANT:

- The covers might be corroded by some chemical and organic solvent and vapor. Do not clean the ACTIVAL using such substances, or do not expose the ACTIVAL to such substances.
- Although the ACTIVAL can be used in high humidity environments (max. 95 %RH), do not immerse the actuator in water.
- Although the ACTIVAL can also be used outdoors, be sure not to expose the ACTIVAL to direct sunlight.

- Install the ACTIVAL in a position allowing easy access for maintenance and inspection. Fig. 2 shows the minimum clearance for maintenance and inspection. When installing the ACTIVAL in a ceiling space, provide an access hole within the 50 cm radius of the ACTIVAL. And, place a drain pan under the valve.
- Do not install the product nearby a steam coil or a hot-water coil.
  High temperature radiation might cause malfunction of the actuator.
- Do not mount the ACTIVAL on a pipe where water hammer occurs, or where solid objects including slug may accumulate.

● **Mounting position**

The ACTIVAL can be mounted in any position ranging from upright to sideways (90° tilted). The ACTIVAL should be installed with its actuator vertically positioned above the valve body. (See Fig. 4.) However, the ACTIVAL must be installed always in upright position outdoors.

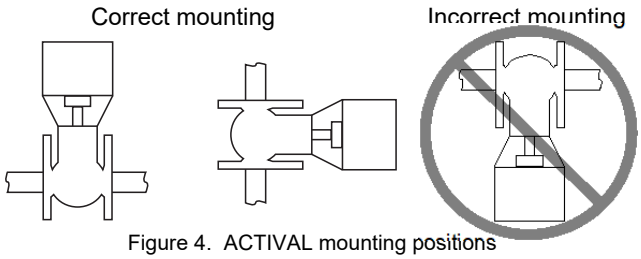


Figure 4. ACTIVAL mounting positions

● **Piping**

⚠ CAUTION
When installing this product, hold it in the proper position and securely fasten it to the pipes. Excessive tightening or improper installation position may damage the valve.

- Check that the model number of the product is what you ordered. The model number is shown on the label attached to the yoke.
- Install a bypass pipe and gate valves on the inflow, outflow, and bypass sides. Also, install a strainer on the inflow side.
- When installing the ACTIVAL to pipes, do not allow any object, such as chips, to get inside a pipe or valve. Valve cannot fully closes, or the valve seat may get damaged causing fluid leakage, due to an object jammed inside the valve.
- When piping, do not apply too much sealing material, such as solidifying liquid and tape, to the pipe connection sections so that these materials flow into the valve. Valve cannot fully closes, or the valve seat may get damaged causing fluid leakage, due to the sealing material jammed inside the valve.
- Before activating the ACTIVAL, fully open (in 100 % position) the valve and flush the pipes (with the ACTIVAL installed) at the maximum flow rate to remove all the foreign substances. (Factory preset position: 100 %)

⚠ CAUTION
After installation, make sure no fluid leaks from the valve-pipe connections. Improper piping may cause fluid leakage outside of the valve.
Do not put a load or weight on this product. Doing so may damage the product.

● **Heat insulation**

Do not apply heat insulation to the actuator or to the yoke, as shown in Fig. 3. If the yoke and the actuator are covered with insulation material, the pointer cannot be checked and may be distorted.

● **Factory preset position**

The actuator shaft is positioned at 100 % (in fully open position) for shipment. The shaft is thus completely turned clockwise, and the pointer points at '100'. (See Fig. 5.)

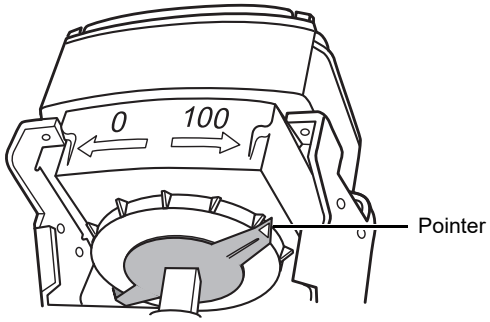


Figure 5. Preset pointer position for shipment

● **Manually opening/closing valve**

IMPORTANT:
- Manually opening/closing the ACTIVAL with the power (24 V AC) applied may damage the actuator.
- To manually open/close the ACTIVAL, do not turn the joint beyond the fully open/closed mark.

Disconnect the power from the ACTIVAL before manually operating the ACTIVAL. As shown in Fig. 6, from the front of the ACTIVAL, hold the joint using a tool such as a wrench, and turn the joint slowly toward the set position.

Note: If shock is sent to the actuator, the actuator may get damaged.

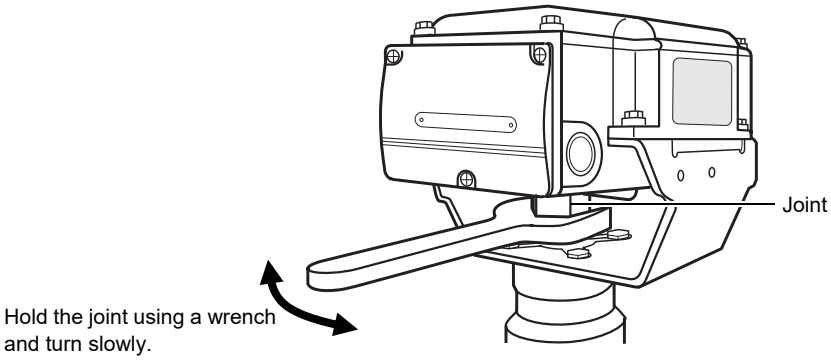


Figure 6. Manual operation

● **Auxiliary switch / Auxiliary potentiometer (optional)**

IMPORTANT:
- The auxiliary switch/potentiometer is installed on site. Refer to the instructions supplied with the auxiliary switch/potentiometer for installation.
- Do not open the top cover except when adjusting the auxiliary switch/potentiometer. Close the top cover instantly after adjusting the auxiliary switch/potentiometer.
- Do not put any load on the top cover.

● **Changing the actuator mounting position**

IMPORTANT:

- Do not change the combination of the valve, yoke, and actuator.
- Set the ACTIVAL (actuator and valve) in 100 % position before changing the mounting position. If the valve in 0 % position is assembled with the actuator in 100 % position, the actuator put torque on the closed valve, and the gear of the actuator get damaged.

1) Remove the screws connecting the actuator and the yoke. Lift the actuator and detach it from the yoke. Make sure that the groove on the top of the valve stem is parallel to the pipes (indicating the valve in 100 % position). <Step 1 in Fig. 7>
2) Remove the screws connecting the yoke and the valve. <Step 2 in Fig. 7>
3) Change the facing direction of the yoke. The yoke and actuator can be horizontally rotated every 90° (0°/90°/180°/270° from the factory preset position) to mount onto the valve.
4) A thermal insulation sheet is inserted between the yoke and the valve. When changing the mounting positions, reinsert the sheet and then fit the yoke into the new mounting position.
5) Before fixing the yoke to the valve with the screws, check that the actuator engages correctly with the valve stem (at the new mounting position). Check that the pointer of the actuator indicates 100 % position as well. Then, fix the yoke to the valve. <Step 3 in Fig. 7>
6) Mount the actuator. Place the actuator, with its facing direction changed, on the yoke, and fix with the screws. <Step 4 in Fig. 7>
7) Check that the ACTIVAL with the mounting position changed operates smoothly (from 0 % to 100 %).

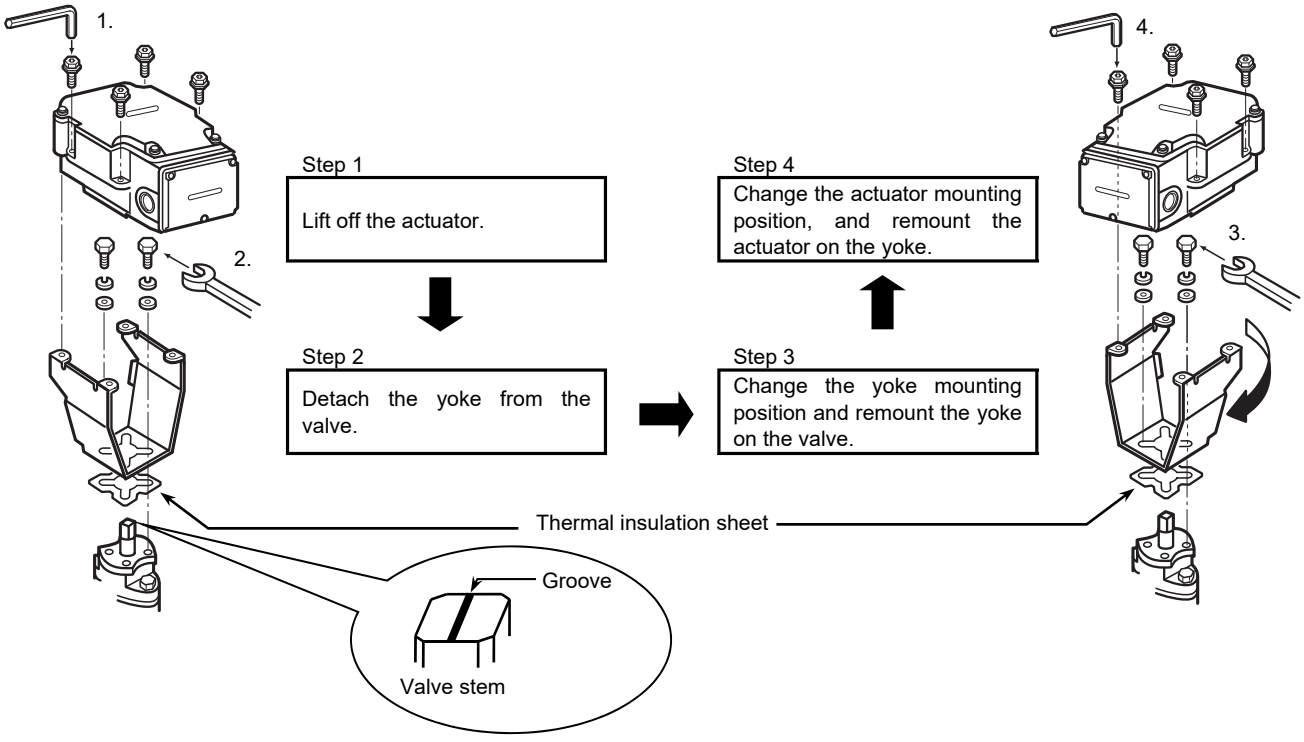


Figure 7. Changing the actuator mounting position

■ Wiring

⚠ CAUTION
Provide a circuit protector (e.g., a fuse or circuit breaker) for the power source. Failure to do so may cause a short circuit leading to fire or device failure.
Install, wire, and use this product under the conditions specified by this manual. Failure to do so may cause fire or device failure.
Installation and wiring of the actuator must be performed by personnel qualified to do instrumentation and electrical work. Mistakes in installation or wiring may cause fire or electric shock.
Before wiring, be sure to turn off the power to this product. Failure to do so may result in electric shock or device failure.
All wiring must comply with applicable codes and ordinances. Otherwise there is a danger of fire.
Use crimp terminals with insulation for connections to the product terminals. Failure to do so may cause short circuit leading to fire or device failure.
Tighten the terminal screws with the specified torque. Insufficient tightening of the terminal screws may cause fire or overheating.

IMPORTANT:

- The ACTIVAL is designed for 24 V AC power supply voltage.
  Do not apply any other power voltage (e.g., 100 V AC, 200 V AC) to the ACTIVAL.
- For 2-10 V DC input type, 0-10 V DC input type and 4-20 mA input type, make sure the polarity of the power supply and 2-10 V DC feedback output referring to Figs 10 to 14. Incorrect wiring may result in PCB (print circuit board) burnout.
- Do not connect 24 V AC power to the terminals 4 to 7.

● Wiring procedure

1) To lead the wires to the terminals, cut out a knockout hole for a wiring port. Two knockout holes are provided on the bilateral sides of the actuator terminals. Select a knockout hole according to the conduit mounting direction, and cut it out by lightly knocking the hole using a screwdriver.

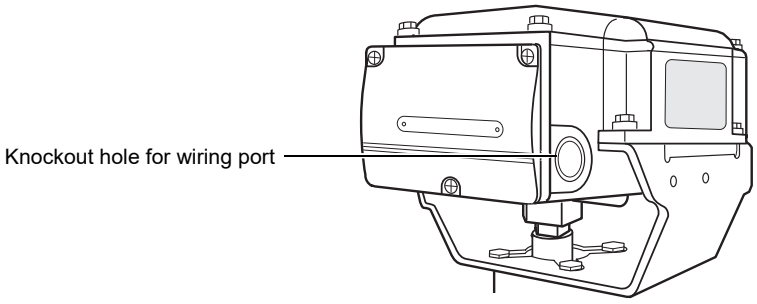
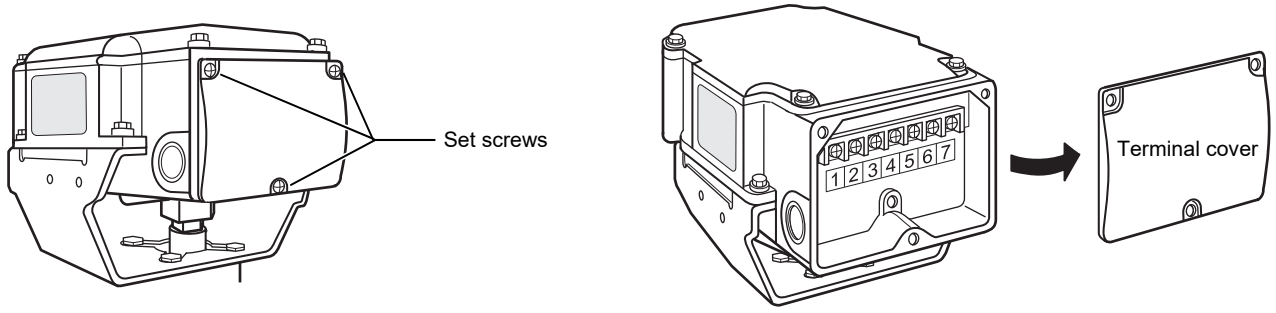


Figure 8. Knockout hole for wiring port

IMPORTANT:

- Do not leave any refuse including metal chips after cutting a knockout hole and after connecting the wires inside the actuator.

2) Unscrew the 3 setscrews (M4 × 10) of the terminal cover and remove the terminal cover, as shown in Fig. 9.



1. Unscrew the setscrews. 2. Remove the terminal cover.

Figure 9. Terminal cover removal

3) Correctly connect the wires to the terminals with M3.5 screw terminal lugs, referring to Figs 10 to 27.

4) When the ACTIVAL is used in a high-humidity environment or outdoors, use a water-proof connector for the wiring port.

⚠ CAUTION
After wiring, be sure to reattach the cover. Failure to do so may result in electric shock.

● **To keep IP54 protection (dust-proof and splash-proof),**

Use a water-proof connector for the ACTIVAL in a high-humidity environment or outdoor location.

- Be sure to completely close the terminal cover and the top cover.
- Waterproof the wiring port.
  - For cable connection, use a water-proof connector. (Seal connector Part No. 83104346-003 is recommended.)
  - For conduit connection, use a water-proof plica tube or the like.

● Terminals connection

Model VY5119J

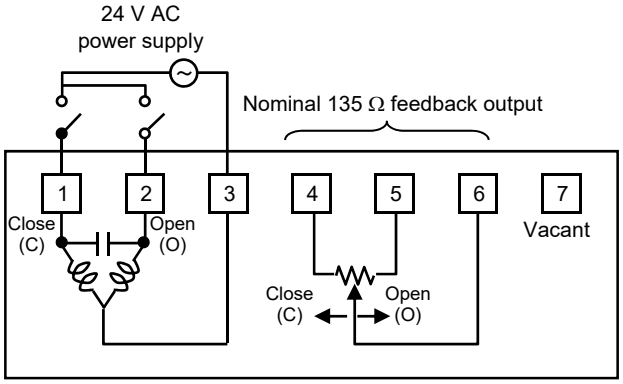


Figure 10. Terminals connection of Model VY5119J
(Nominal 135 Ω feedback potentiometer type)

∗ Note:
Controller that receives voltage between the terminals 4 and 6 as feedback signal is recommended to connect.

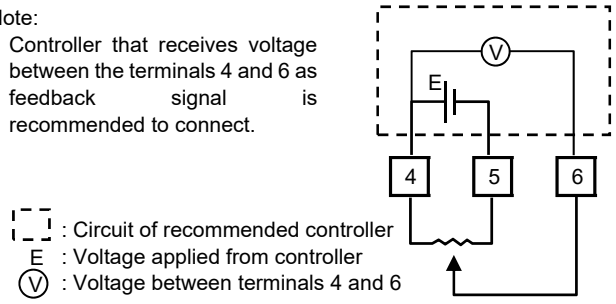


Figure 11. Circuit of recommended controller

Model VY5129J

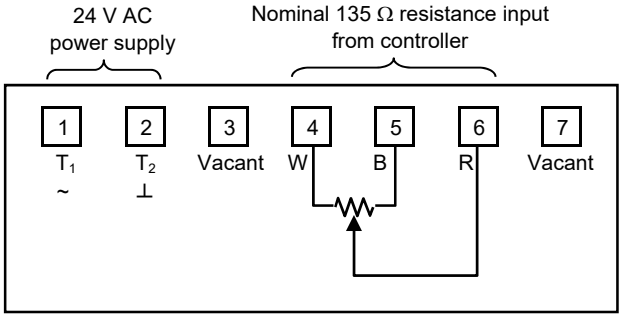
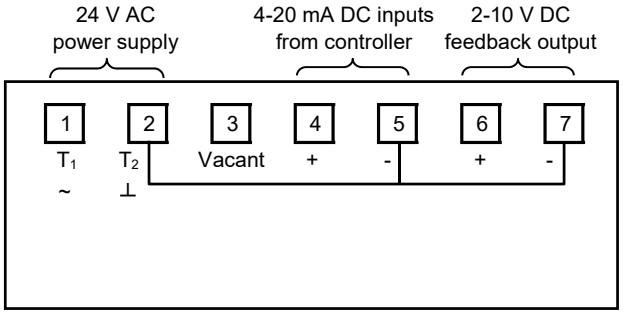


Figure 12. Terminals connection of Model VY5129J
(Nominal 135 Ω resistance input type)

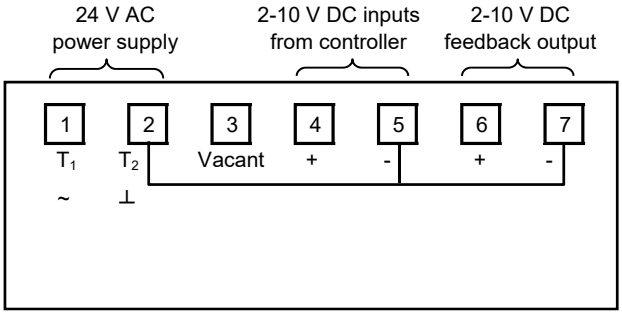
Model VY5139J



∗Note:
Terminals 2, 5, and 7 are connected inside the actuator.

Figure 13. Terminals connection of Model VY5139J
(4-20 mA DC input type)

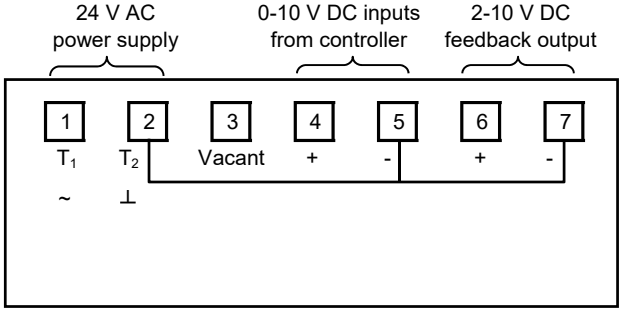
Model VY5149J



∗Note:
Terminals 2, 5, and 7 are connected inside the actuator.

Figure 14. Terminals connection of Model VY5149J
(2-10 V DC input type)

Model VY5159J



∗Note:
Terminals 2, 5, and 7 are connected inside the actuator.

Figure 15. Terminals connection of Model VY5159J
(0-10 V DC input type)

■ Wiring Examples

● Model VY5119J (Control signal: Nominal 135 Ω feedback potentiometer)

Single [ACTIVAL + Infilex™ GC (Model WY5111 with Model RY5001F)+ transformer]

Constraint:

* For power supply, provide an isolation transformer.

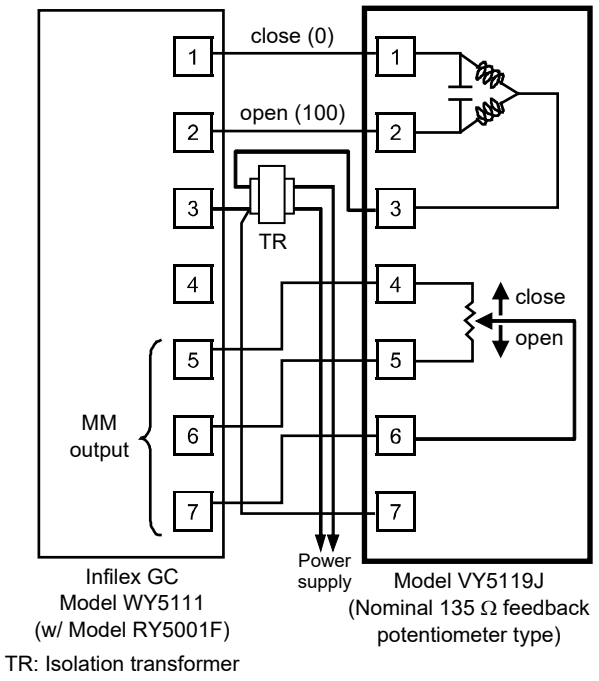


Figure 16. Connection example:
Model VY5119J to Model WY5111 (w/ Model RY5001F)

● Model VY5129J (Control signal: Nominal 135 Ω resistance input)

Single [ACTIVAL + Neostat (Model TY900_Z)+ transformer]

Constraint:

* For power supply, provide an isolation transformer.

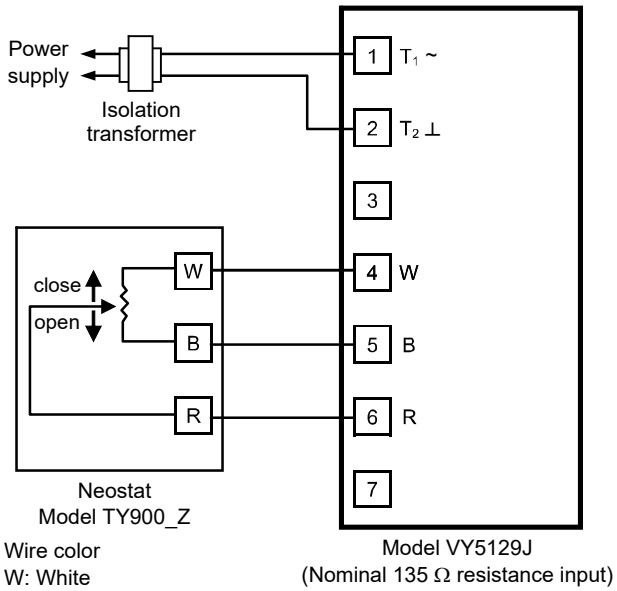


Figure 17. Connection example:
Model VY5129J to Model TY900_Z

● **Model VY5139J (Control signal: 4-20 mA DC input)**

Single [ACTIVAL + R series (Model R35/R36) + transformer]

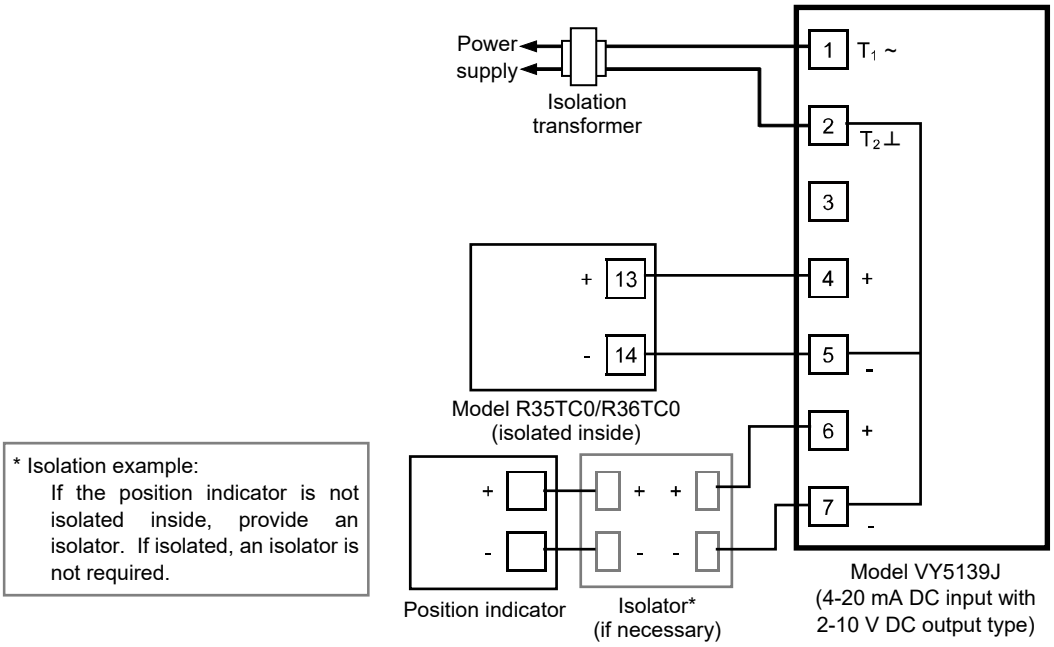


Figure 18. Connection example (1): Model VY5139J to Model R35TC0/R36TC0

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.

  Note: Model R35/R36 is internally isolated.

● **Model VY5139J (Control signal: 4-20 mA DC input)**

Multiple [ACTIVAL + R series (Model R35/R36)] + single transformer

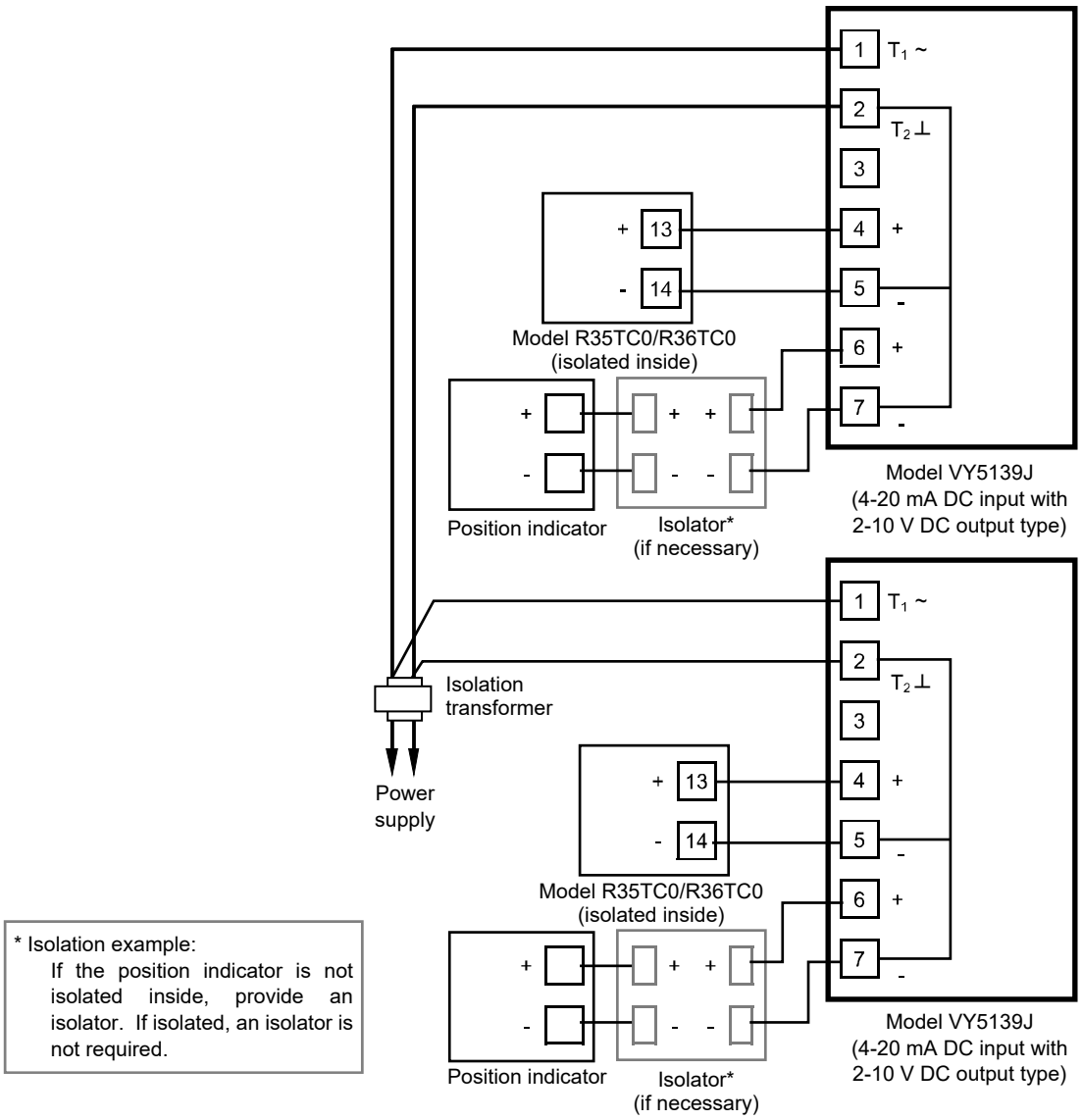


Figure 19. Connection example (2): Model VY5139J to Model R35TC0/R36TC0

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.

  Note: Model R35/R36 is internally isolated.
* When the transformer is shared with multiple ACTIVAL, connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.

● **Model VY5139J (Control signal: 4-20 mA DC input)**

Multiple ACTIVAL + single R series (Model R35/R36) + single transformer

Constraints

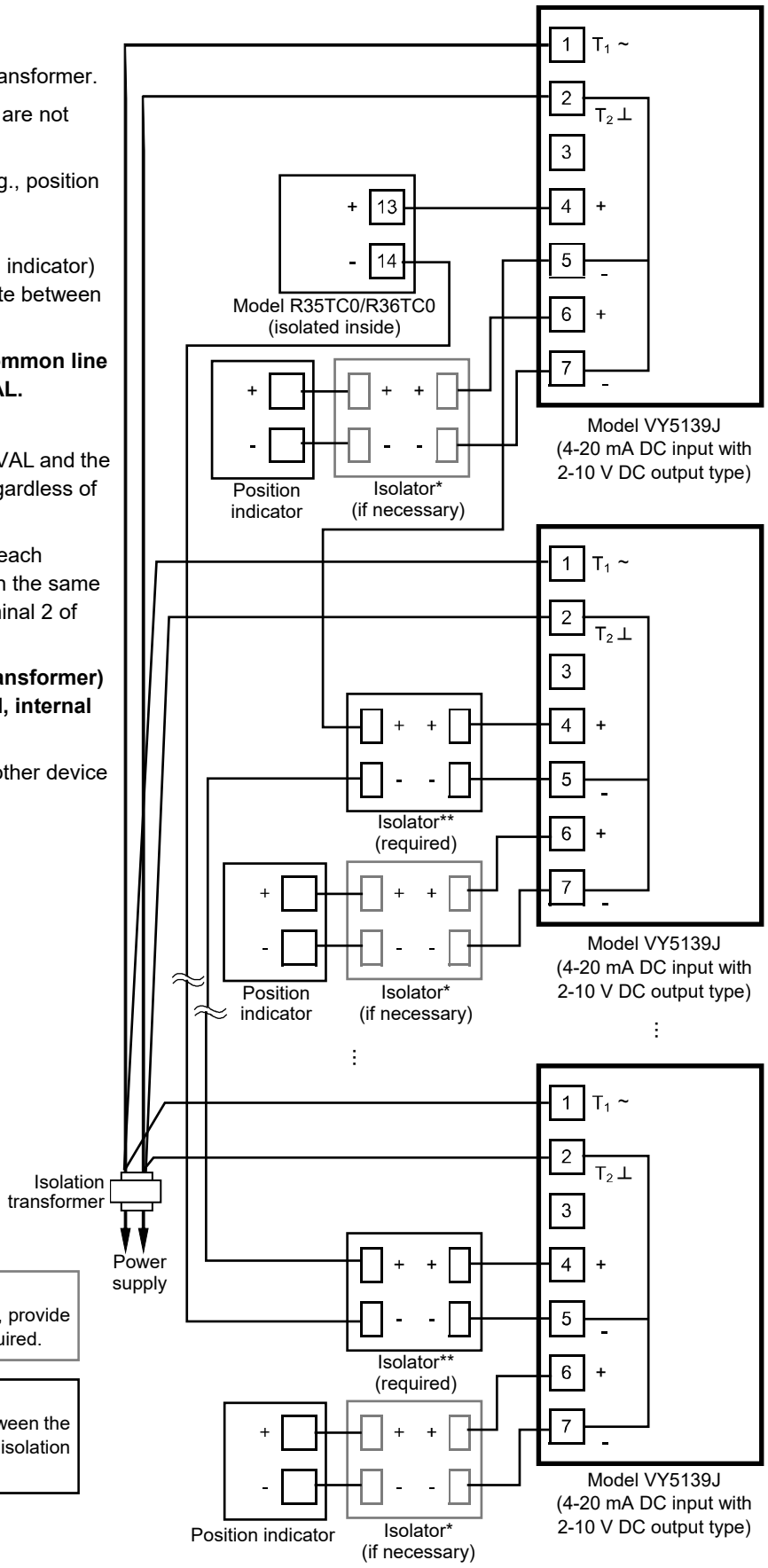
* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.

  Note: Model R35/R36 is internally isolated.
* Never fail to isolate between slave-ACTIVAL and the controller (Model R35/R36 in Fig. 20) regardless of internal isolation of the controller.
* Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.



* Isolation example:
  If the position indicator is not isolated inside, provide an isolator. If isolated, an isolator is not required.

** Isolation example:
  Provide an isolator. Isolation is required between the controller and slave-ACTIVAL regardless of isolation of the controller.

Figure 20. Connection example (3):
Model VY5139J to Model R35TC0/R36TC0

● **Model VY5149J (Control signal: 2-10 V DC input)**

Single [ACTIVAL + Infilex™ AC (Model WY5117) + transformer]

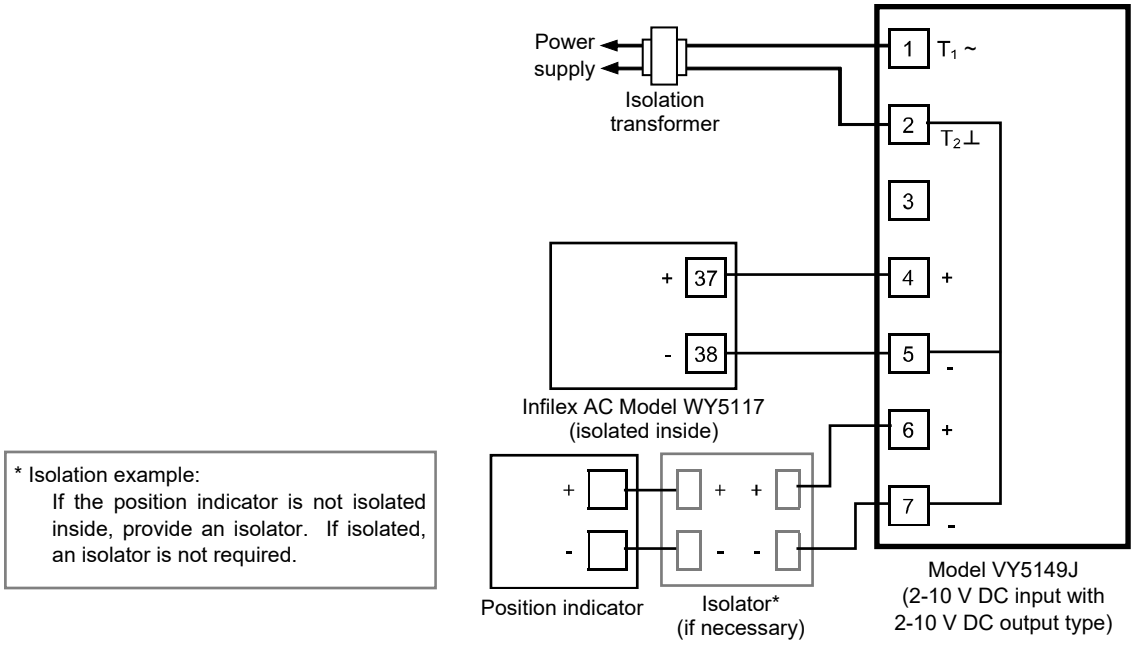


Figure 21. Connection example (1): Model VY5149J to Model WY5117

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.

  Note: Model WY5117 is internally isolated.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.
  (Infilex AC Model WY5117 in Fig. 21 is internally isolated, and its power supply voltage is 24 V AC. Therefore, the transformer can be shared.)

● **Model VY5149J (Control signal: 2-10 V DC input)**

Multiple [ACTIVAL + Infilex™ AC (Model WY5117)] + single transformer

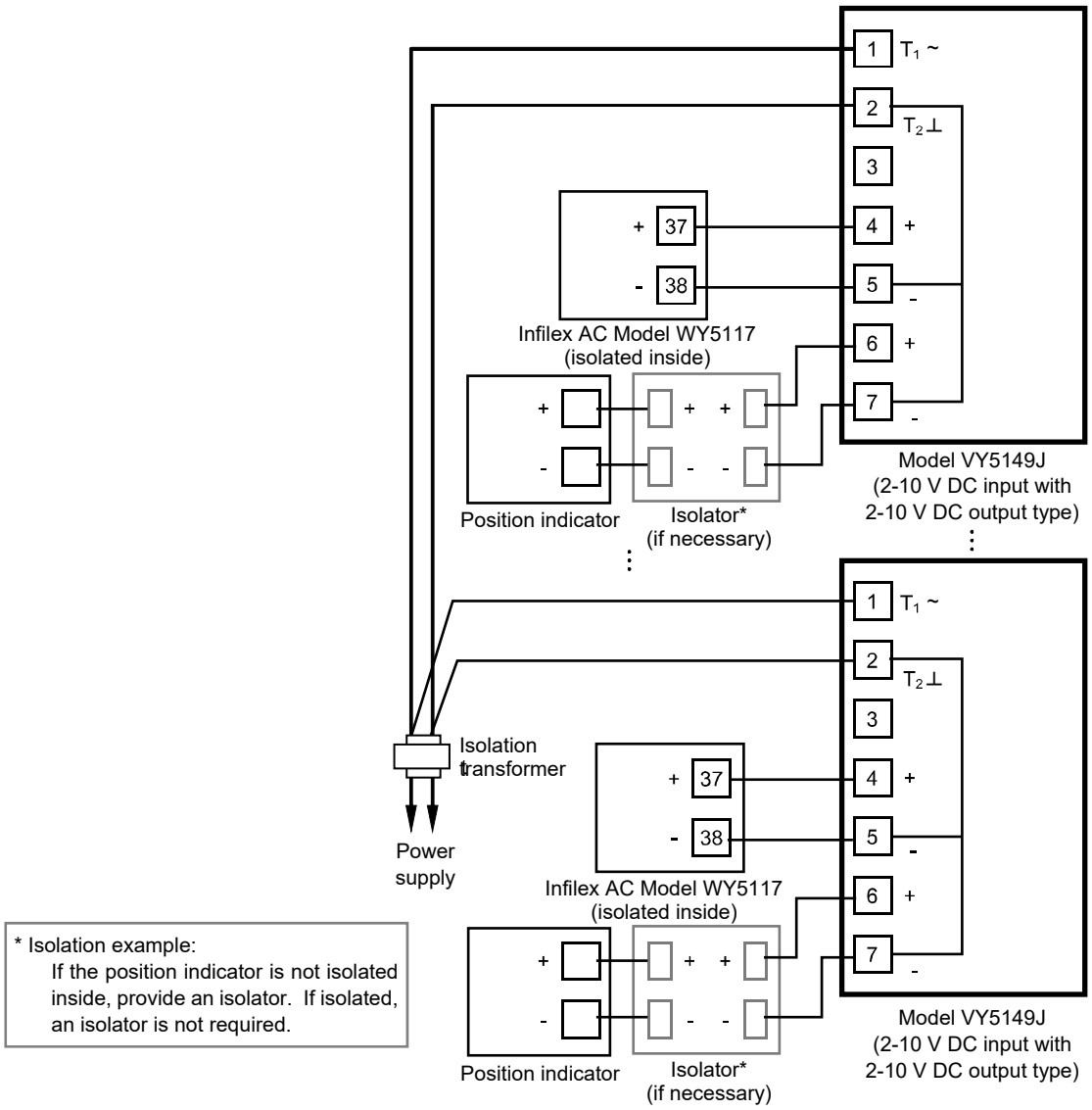


Figure 22. Connection example (2): Model VY5149J to Model WY5117

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.

  Note: Model WY5117 is internally isolated.
* Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.
  (Infilex AC Model WY5117 in Fig. 22 is internally isolated, and its power supply voltage is 24 V AC. Therefore, the transformer can be shared.)

● **Model VY5149J (Control signal: 2-10 V DC input)**

Multiple ACTIVAL + single Infilex™ AC (Model WY5117) + single transformer:

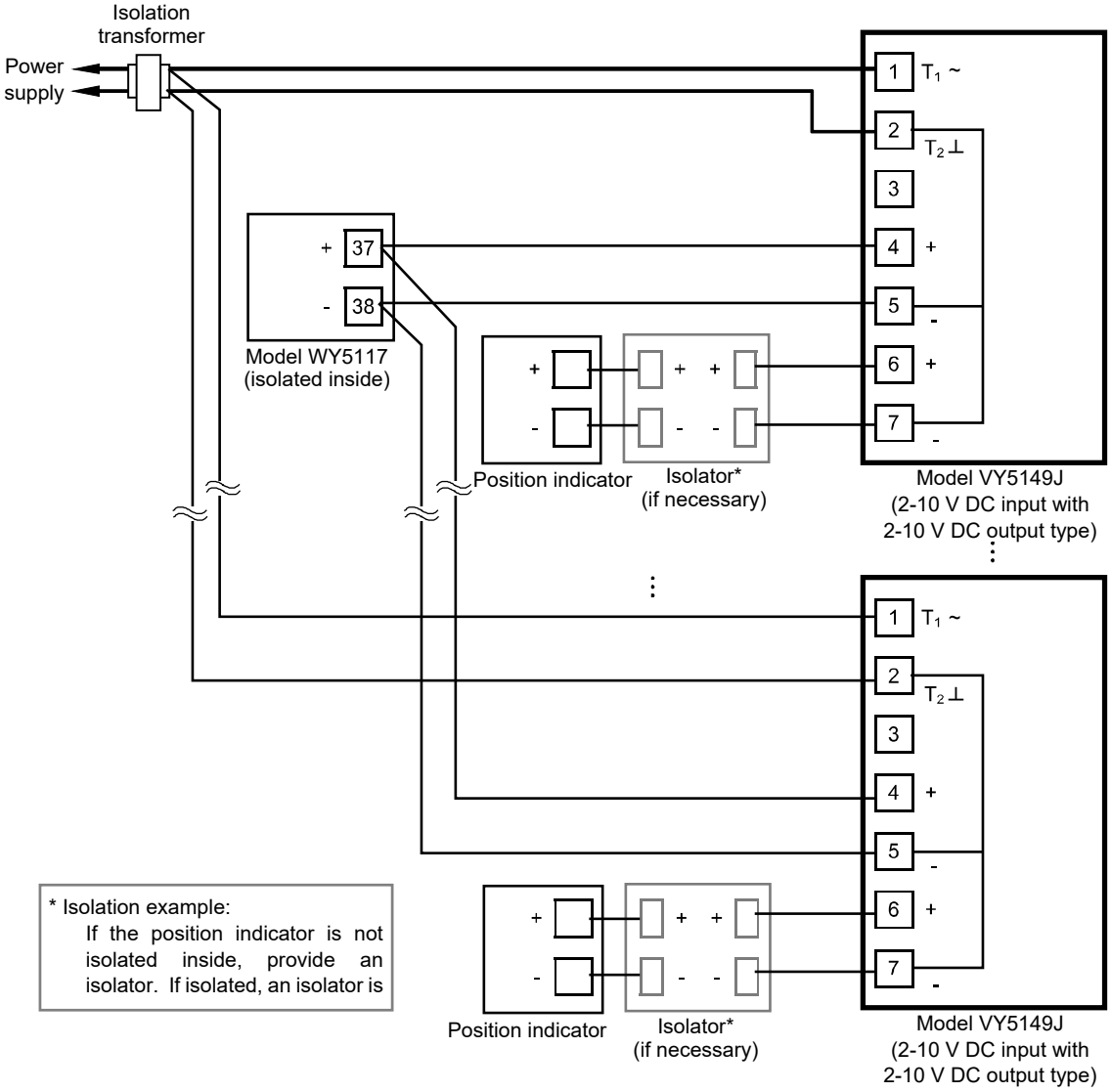


Figure 23. Connection example (3): Model VY5149J to Model WY5117

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.

  Note: Model WY5117 is internally isolated.
* Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.
  (Infilex AC Model WY5117 in Fig. 23 is internally isolated, and its power supply voltage is 24 V AC. Therefore, the transformer can be shared.)

● **Model VY5149J (Control signal: 2-10 V DC input)**

ACTIVAL × 2 + single Infilex™ AC (Model WY5117) + single transformer shared with controller (System common wiring):

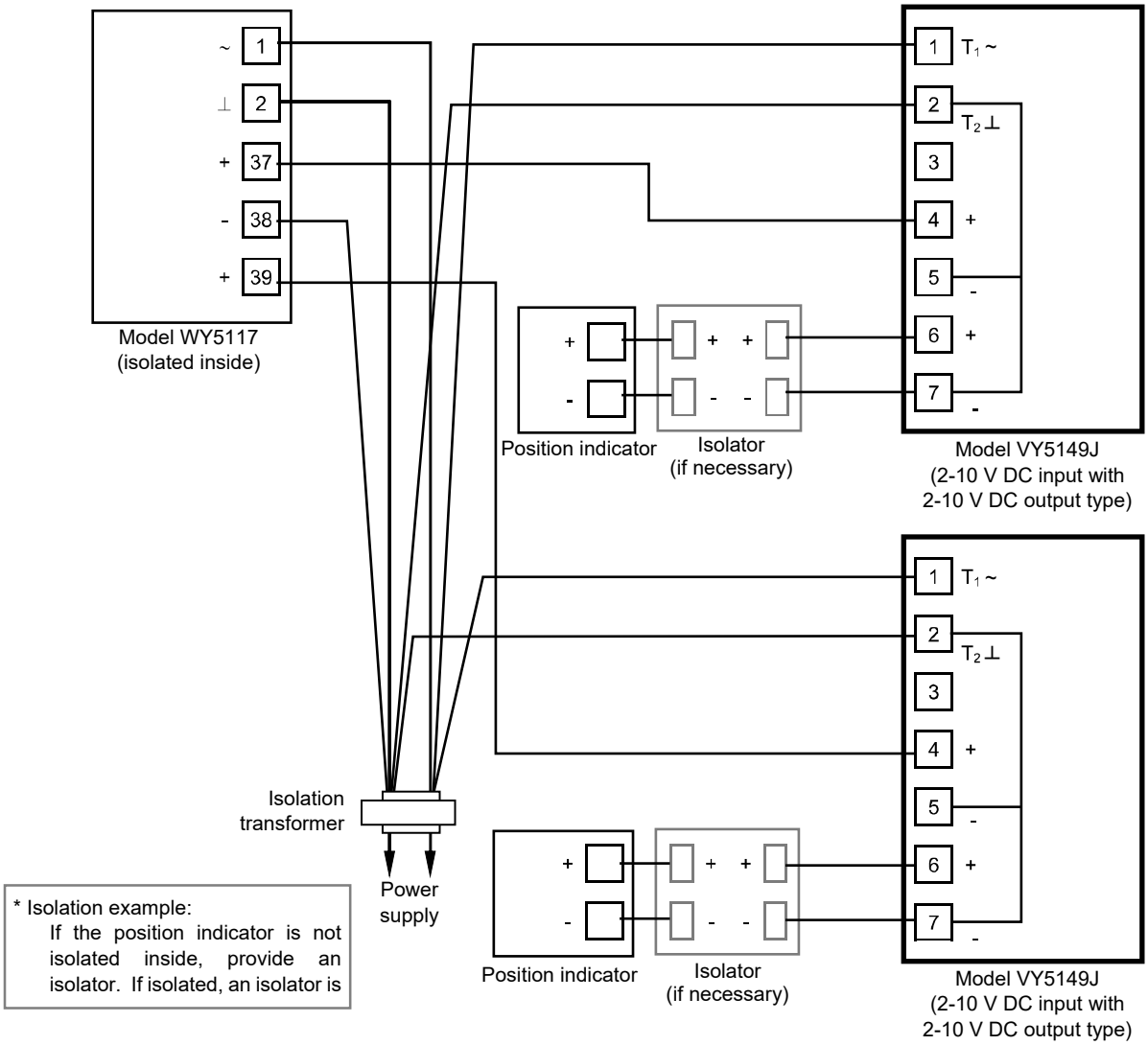


Figure 24. Connection example (4): Model VY5149J to Model WY5117

Constraints

- For power supply, provide an isolation transformer.
- The terminals 2, 5, and 7 of the actuator are not isolated inside:
  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.
  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.
  Note: Model WY5117 is internally isolated.
- Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
- Do not pass the power supply line to another device through the terminals of ACTIVAL.
- If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.
  (Infilex AC Model WY5117 in Fig. 24 is internally isolated, and its power supply voltage is 24 V AC. Therefore, the transformer can be shared.)

System common wiring (All of the above constraints must be satisfied for System common wiring.):

As shown in Fig. 24, the transformer for ACTIVAL is shared with the controller, and the ground line (⊥) is used as the common line (-). Thus, common line between ACTIVAL and the controller is omitted.

● **Model VY5159J (Control signal: 0-10 V DC input)**

Single [ACTIVAL + a third-party controller with 0-10 V DC output + transformer]

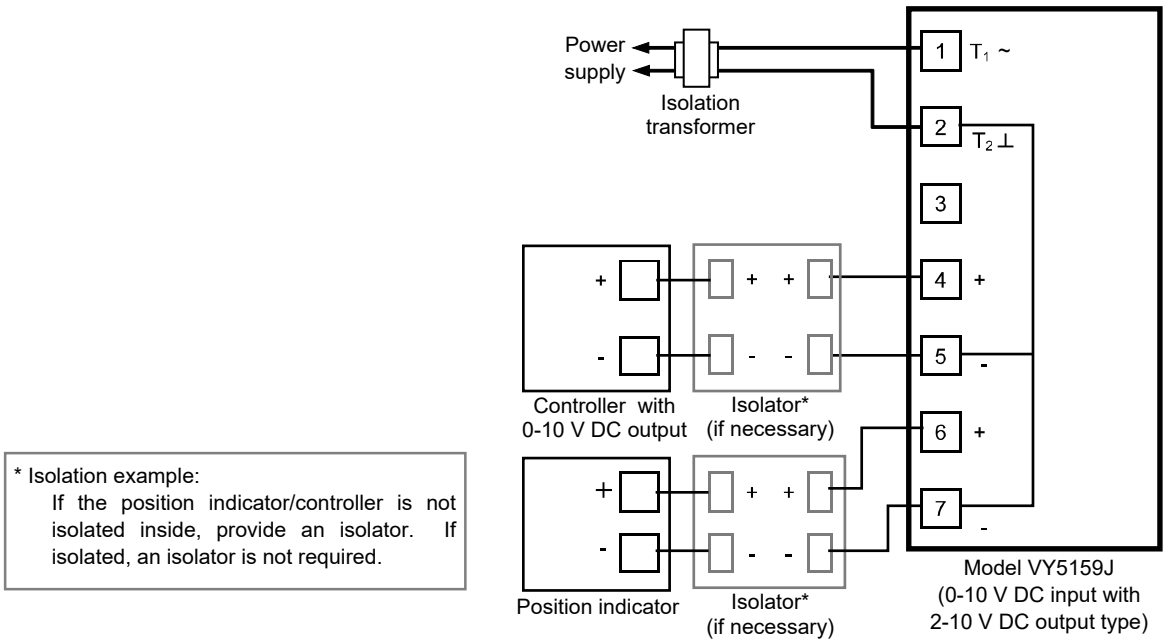


Figure 25. Connection example (1): Model VY5159J to a controller with 0-10 V DC output

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.

● **Model VY5159J (Control signal: 0-10 V DC input)**

Multiple [ACTIVAL + third-party controller with 0-10 V DC output] + single transformer

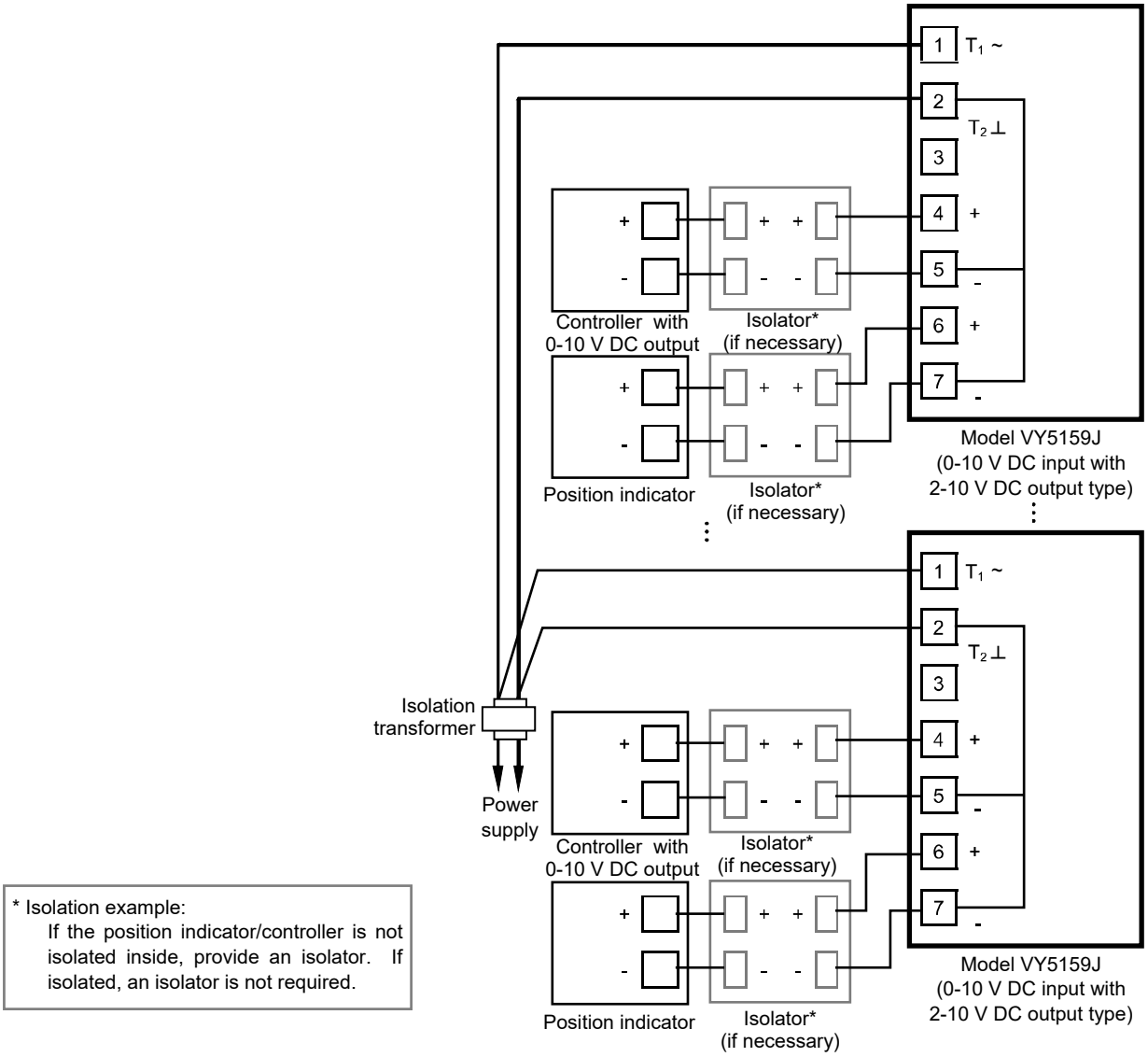


Figure 26. Connection example (2): Model VY5159J to a controller with 0-10 V DC output

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., controller, position indicator).
  OR
  If the terminals of a device (e.g., controller, position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.
* Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.

● **Model VY5159J (Control signal: 0-10 V DC input)**

Multiple ACTIVAL + single third-party controller with 0-10 V DC output + single transformer

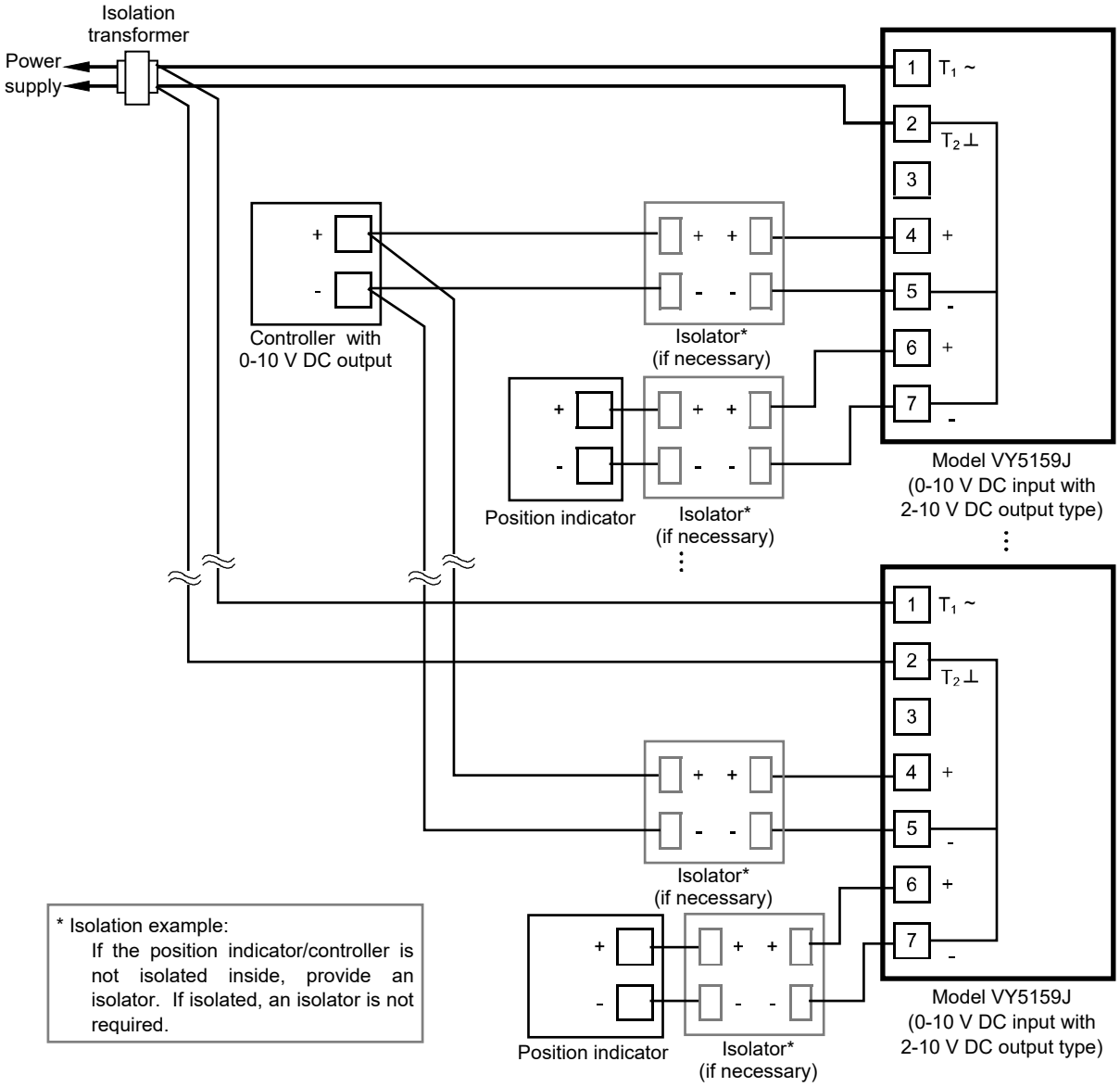


Figure 27. Connection example (3): Model VY5159J to a controller with 0-10 V DC output

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., controller, position indicator).
  OR
  If the terminals of a device (e.g., controller, position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.
* Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.

● **Model VY5159J (Control signal: 0-10 V DC input)**

ACTIVAL × 2 + single third-party controller (0-10 V DC output)+ single transformer shared with controller (System common wiring)

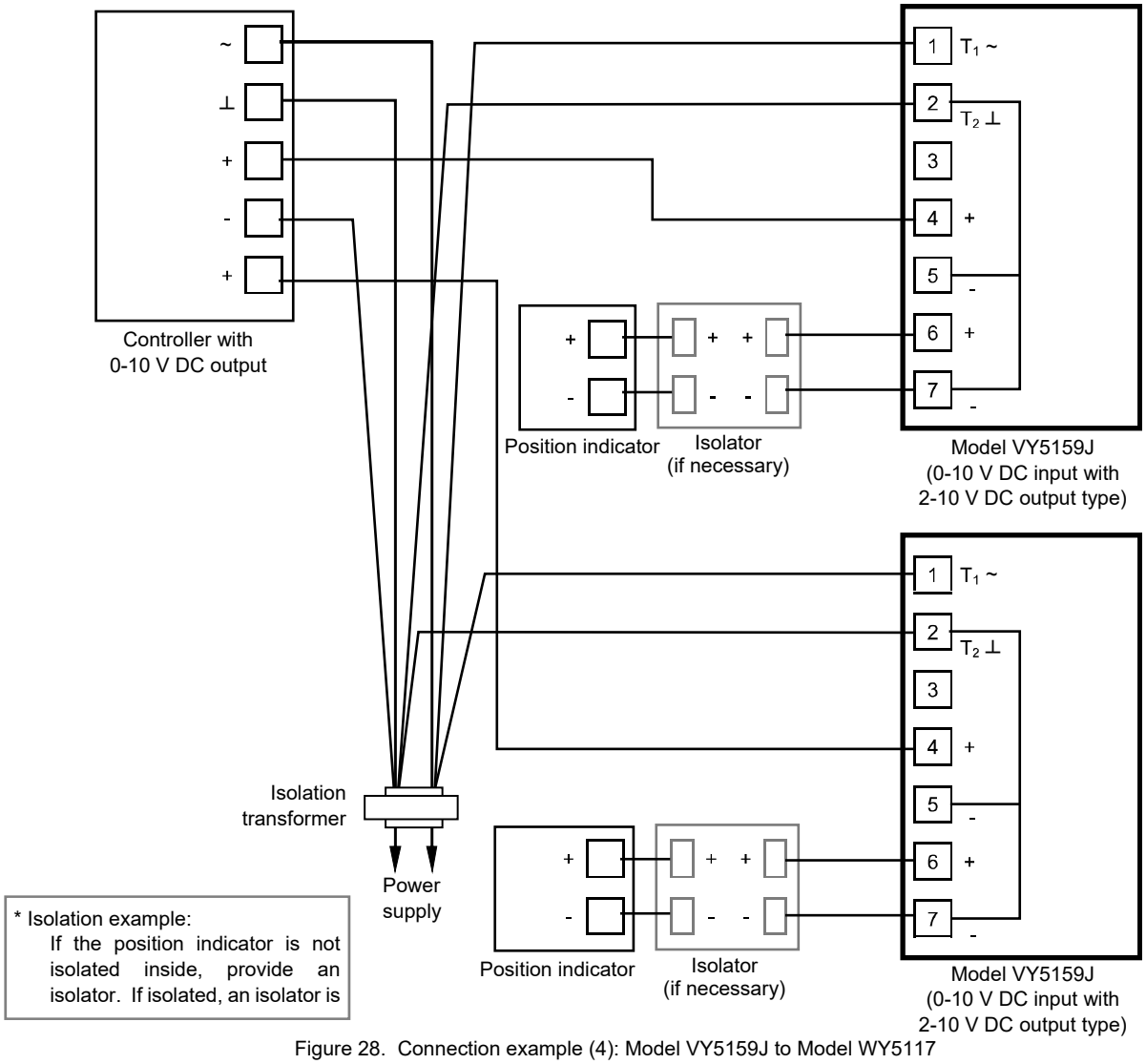


Figure 28. Connection example (4): Model VY5159J to Model WY5117

Constraints

* For power supply, provide an isolation transformer.
* The terminals 2, 5, and 7 of the actuator are not isolated inside:

  Connect an internally isolated device (e.g., position indicator).
  OR
  If the terminals of a device (e.g., position indicator) are unknown or not isolated inside, isolate between the ACTIVAL and the device.

  Otherwise, a loop is formed for the common line and can damage the circuit of ACTIVAL.
* Connect the lines from the terminal 1 of each ACTIVAL to the transformer terminal with the same polarity. Connect the lines from the terminal 2 of each ACTIVAL the same way.

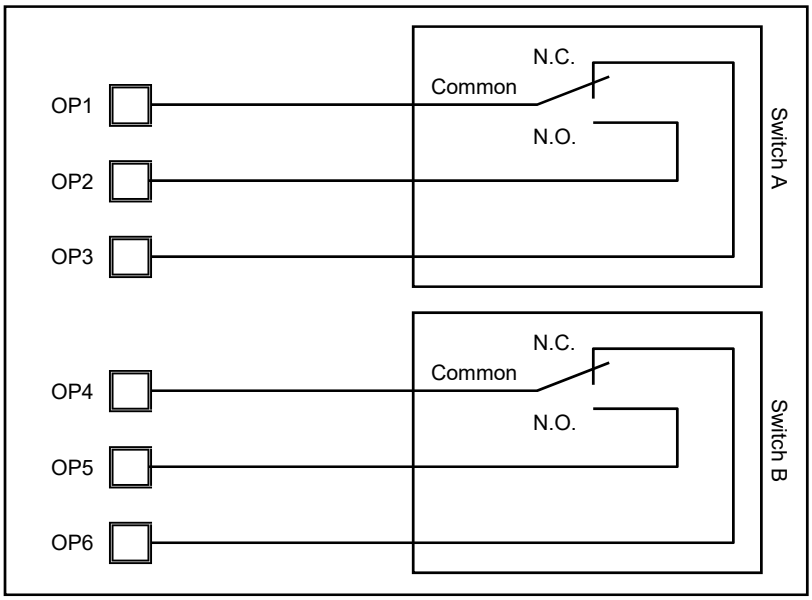
  If the terminals (of ACTIVAL and of transformer) with different polarities are connected, internal circuit of ACTIVAL may get damaged.
* Do not pass the power supply line to another device through the terminals of ACTIVAL.
* If the power supply voltage of the controller is 24 V AC (same as ACTIVAL) AND the controller is internally isolated, transformer for the ACTIVAL can be shared with the controller.

System common wiring (All of the above constraints must be satisfied for System common wiring.):

As shown in Fig. 28, the transformer for ACTIVAL is shared with the controller, and the ground line (⊥) is used as the common line (-). Thus, common line between ACTIVAL and the controller is omitted.

■ Internal Connection of Auxiliary Switch / Auxiliary Potentiometer

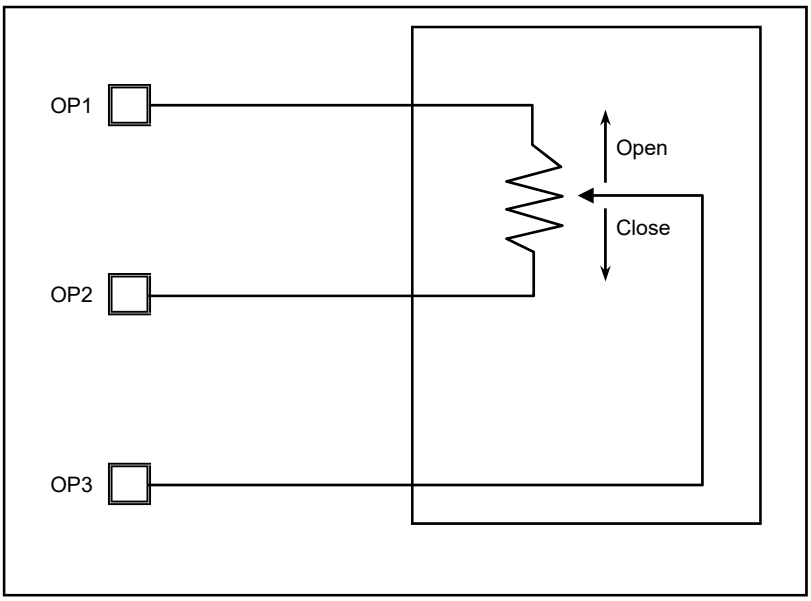
● Auxiliary switch Part No. 83174063-101



Switches A and B actuating position: Adjustable between 0 % (fully closed) and 100 % (fully open)

Figure 29. Internal connection of Model 83174063-101

● Auxiliary potentiometer Part No. 83165275-001



Potentiometer operating position: Adjustable between 0 % (fully closed) and 100 % (fully open)

Figure 30. Internal connection of Model 83165275-001

■ Maintenance

⚠ CAUTION
Do not put a load or weight on this product. Doing so may damage the product.
Before doing maintenance, be sure to turn off the power to this product. Failure to do so may result in electric shock or device failure.
After maintenance, be sure to reattach the cover. Failure to do so may result in electric shock.
Do not carelessly touch this product when it is used to control hot water. Doing so may result in burns, because the product reaches a high temperature.

- Manually open/close the ACTIVAL at least once a month if it is left in inactive state for a long period.
- Inspect the ACTIVAL according to Table 1.
- Visually inspect the fluid leakage of the valve and the actuator operations every six months. If any of the problems described in Table 2 are found, take corresponding actions shown in the table.
  If your problem is not solved by the corresponding action, please contact Azbil Corporation near you.

Table 1. Inspection items and details

Inspection item	Inspection interval	Inspection detail
Visual inspection	Semiannual	• Fluid leakage from the gland and the flange face • Loosened bolts • Valve and actuator damages
Operating status	Semiannual	• Unstable open/close operation • Abnormal noise and vibration
Routine inspection	Any time	• Fluid leakage to the outside • Abnormal noise and vibration • Unstable open/close operation • Valve hunting

Table 2. Troubleshooting

Problem	Part to check	Action
Fluid leaks from the flange face.	Loosened flange bolts Gasket on the flange face Misaligned piping	Tighten the flange bolts. Replace the gasket. Redo piping.
Fluid leaks from the gland.	—	Consult with our sales personnel.
Fluid leaks from the bonnet.	Loosened bolts	Tighten the bolts.
Valve does not operate smoothly / valve stops halfway / valve does not operate at all.	Conditions of the power applied and of the input signal applied Loosened terminals Wiring conditions / disconnected wires	Check the power supply and the controller connected to. Tighten the terminals. Check the wiring.
Fluid leaks to the outside of the ACTIVAL when the valve is in fully closed position.	Actuator pointer not pointing to fully closed position	Fully close the ACTIVAL.
The valve vibrates or produces an abnormal noise.	Primary pressure condition Differential pressure condition	Adjust the mounting position and change the installation location.
The auxiliary switch does not actuate.	Auxiliary switch (cam switch) condition Loosened terminals Wiring condition / disconnected wires	Redo the cam switch setting. Tighten the terminals. Check the wiring.
The auxiliary potentiometer does not operate.	Condition of resistance Loosened terminals Wiring condition / disconnected wires	Check the resistance value (1 kΩ). Tighten the terminals. Check the wiring.
Valve hunting occurs.	Secondary pressure condition Differential pressure condition Control stability	Adjust the mounting position and change installation location. Connect the control parameters setting for controller.
Voltage/current input signal disagrees with the feedback output signal.	To completely shut off the valve, valve open and close (0-100% position) operation is controlled by 10-90 % range of actuator voltage/current input signal. Voltage/current input signal therefore disagrees with the feedback signal, and this is not an error.	

■ Disposal

Dispose of this product as industrial waste in accordance with your local regulations.
Do not reuse all or any part of the product.

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This product complies with the following harmonised standards of the Electromagnetic Compatibility Directive (EMCD).
EMCD: EN61000-6-2
EN55011 Class A, Group 1

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Specifications are subject to change without notice.