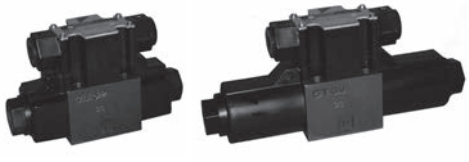
Low-watt Type Solenoid Valve



For AC power supply　　For DC power supply

Features

- These solenoid valves use low-wattage type coils (DC: 5 W, AC: 12 W).
- The low current specification allows this valve to be driven directly with a PLC (programmable logic controller)

Nomenclature

※	–	LS	–	G	02	–	※※	※	※	–	30	–	※※※
1		2		3	4		5	6	7		8		9

M12-4-pin connector specifications

LS	–	G	02	–	※※	※	P	–	30	–	D	3B
2		3	4		5	6	7		8		10	11

1 Applicable fluid code
No designation: Petroleum-based hydraulic fluid
F: Phosphate ester hydraulic fluid

2 Model No.
LS: Low-wattage type solenoid valve

3 Connections
G: Gasket mount type

4 Nominal diameter
02: ¼

5 Spool type (See the model table)

6 Spool operating method (See the model table)
C: Spring center type
A: Spring offset type (with A solenoid)
B: Spring offset type (with B solenoid)
N: No-spring type (without detent)
D: No-spring type (with detent)

7 Voltage code (See the solenoid specification table)

8 Design No. (The design No. is subject to change)

9 Option code (See the option code table)

10 Connector code
D: M12-4-pin connector specifications

11 Connector connecting method
3B: Load side: Negative common
Wiring port: Outlet at port B side

Note: With M12-4-pin connector specifications, only 2C, 4C, 44C, 2B and 2D can be designated for 5 Spool type and 6 Spool operating method.

Specifications

Model No.	Nominal diameter	Maximum operating pressure MPa {kgf/cm²}	Maximum flow rate *1 L/min	Permissible back pressure MPa {kgf/cm²}	Maximum switching frequency Times per minute
LS-G02-※※※※-30	¼	7 { 70}	30	7 {70}	240
LS-G02-※※※※-30-※W		16 {160}		12 (AC) {120}	
				14 (DC) {140}	
LS-G02-※※※※-30-D3B		7 { 70}		7 {70}	120

Note: *1 The maximum flow rate is 15 L/min when 66C is designated for the spool type and spool operating method.

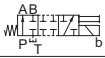
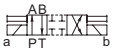
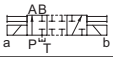
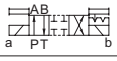
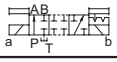
7 : Solenoid specification table

Voltage code	Power supply voltage	Starting current A	Holding current A	Holding power W	Permissible voltage fluctuation (%)
A	AC 100 V (50 Hz)	1.13	0.32	12.0	80 to 110
	AC 100 V (60 Hz)	1.02	0.22	8.5	90 to 121
	AC 110 V (60 Hz)	1.13	0.26	11.2	82 to 110
B	AC 200 V (50 Hz)	0.57	0.16	12.0	80 to 110
	AC 200 V (60 Hz)	0.51	0.11	8.5	90 to 121
	AC 220 V (60 Hz)	0.57	0.13	11.2	82 to 110
P	DC 24 V*2	–	0.22	5.2	90 to 110

Time rating	Insulation resistance	Withstand voltage	Insulation type
Continuous	50 MΩ	AC 1500 V, 1 minute	Type B (Coils: AC: H class, DC: F class)

Note: ○ The electric current and power indicated are the values at 20°C.
○ The starting current is the value required to operate the solenoid with the movable core at the furthest position from the stationary core.
*2. With DC power supply voltage, solenoid valves with a surge killer (option code: N, EN) are recommended to prevent reverse surge voltage that may occur at demagnetization of the solenoid.

5 6 : Model table

Model code JIS graphic symbols for hydraulic system			Power supply	Pressure - Flow rate characteristics (See the graphs)			Pressure drop characteristics (See the graphs)		
Spool type and spool operating method							P → A P → B	A → T B → T	P → T
Type C, N, D	Type A	Type B							
LS-G02-2C *2 	–	–	AC	A	a	a	(3)	(5)	–
			DC	D F	b c	b c			
LS-G02-3C 	–	–	AC	A	A	A	(4)	(3)	(3)
			DC	A	A	A			
LS-G02-4C*2 	–	–	AC	B	a	a	(3)	(6)	–
			DC	E G	b c	b c			
LS-G02-44C 	–	–	AC	B	a	a	(2)	(5)	–
			DC	E G	b c	b c			
LS-G02-66C 	–	–	AC	C	e	e	(1)	(1)	(3)
			DC	C	e	e			
LS-G02-7C 	–	–	AC	A	g	g	(6)	(5)	–
			DC	A	g	g			
LS-G02-8C 	–	–	AC	B	a	a	(3)	(5) (3)	–
			DC	G	c	c			
LS-G02-9C 	–	–	AC	A	g	a	(5) (3)	(3)	–
			DC	G	g	c			
–	LS-G02-2A 	–	AC	A	A	f	(5)	(5)	–
			DC	A	h	f			
–	LS-G02-20A 	–	AC	–	A	f	(4)	–	–
			DC	–	h	f			
–	–	LS-G02-2B *2 	AC	A	f	A	(5)	(5)	–
			DC	A	f	h			
–	–	LS-G02-20B 	AC	–	f	A	(4)	–	–
			DC	–	f	h			
LS-G02-2N 	–	–	AC	A	d	d	(3)	(5)	–
			DC	A	d	d			
LS-G02-20N 	–	–	AC	–	d	d	(5)	–	–
			DC	–	d	d			
LS-G02-2D *2 	–	–	AC	A	d	d	(5)	(3)	–
			DC	A	d	d			
LS-G02-20D 	–	–	AC	–	d	d	(5)	–	–
			DC	–	d	d			

Note: ∗3 With M12-4-pin connector specifications, only 2C, 4C, 44C, 2B and 2D can be designated.

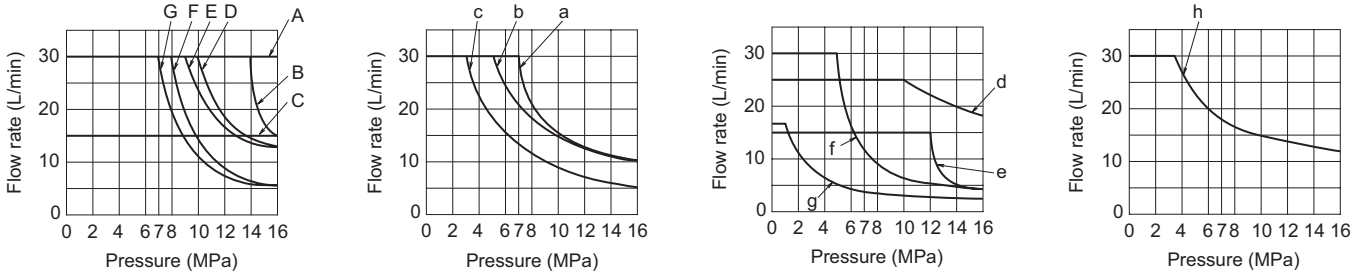
9 : Option code table

Option code	Option details					Notes
No designation	Terminal box type	With lamp	With earth terminal		Without surge killer	
N					With surge killer	
NR					With surge killer (with resistance)	∗4
E				CE standard compliant	Without surge killer	∗5
C	DIN connector type	Without lamp				∗6
CE				CE standard compliant		∗5,6
CL		With lamp				∗6
CLE				CE standard compliant		∗5,6
N-CLE					With surge killer	∗8
C1		Without DIN connector socket				∗6
W	High-pressure model (maximum operating pressure: 16 MPa)					∗7

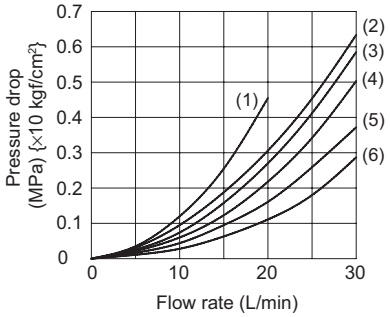
Note: ○ If two or more options are selected, sort the option codes in alphanumeric order.
∗4 The specifications with surge killer (with resistance) are only applicable to voltage code P.
∗5 Only voltage codes A and P can be designated for CE compliant products (option code: E, EN, ENR, CE, CLE). (Voltage codes other than A and P are not compliant with the CE standards.)
∗6 The DIN connector type is only applicable to voltage codes A and B.
∗7 The high-pressure model can only be used when the spool model/spool operating method is other than 44C.
∗8. The option code (N-CLE) can only be used when the voltage code is P.

Performance curves (viscosity: 32 mm²/s {cSt})

Pressure - Flow rate characteristics



Pressure drop characteristics



Note: ○ The flow rates shown in the graphs are the maximum flow rates under which operation (switching) of the valve is possible under the following conditions.

AC	After rising to the saturation temperature, 90% of rated voltage applied (60 Hz)
DC	After rising to the saturation temperature, 90% of rated voltage applied

○ In the 5 model table, the conditions for each of the values given in the two rows for DC power supply are as follows.
Top row: After rising to the saturation temperature, 100% of rated voltage applied
Bottom row: After rising to the saturation temperature, 90% of rated voltage applied

Operation time (Sec.)

Power supply	Applicable wiring method	Operating direction	Operation time
AC	Terminal box type DIN connector type	Energize	0.01 to 0.03
		Spring return	0.01 to 0.05
DC	Terminal box type	Energize	0.01 to 0.08
		Spring return	0.02 to 0.04
	M12-4-pin connector type	Energize	0.01 to 0.08
		Spring return	0.05 to 0.12

Mass (kg)

Double solenoid		Single solenoid	
AC	DC	AC	DC
1.5	2.2	1.3	1.6

Note: ○ The operation time may change slightly depending on the spool code, conditions of use (pressure, flow rate, hydraulic fluid viscosity, etc.).
○ Solenoid valves with M12-4-pin connector specifications incorporate a diode to absorb surge current. Therefore there will be a slight delay in the operation time at spring return when compared to terminal box type/DIN connector type solenoid valves.

Sub-plate model code

● The sub-plate is not provided with the valve. Order it separately if required by specifying the model code given in the table below.

Model code	Nominal diameter	Connection port diameter	Mass kg
JS-01M02	1/4	Rc1/4	0.64

Refer to Page S-9 for the dimensions of the sub-plate.

Mounting bolt

Hexagon socket head cap bolt	Quantity	Tightening torque N·m {kgf·cm}
M5 × 45	4	6 to 8 {60 to 80}

Note: LS-G02 is not provided with mounting bolts.

Solenoid model codes

Power supply	Applicable wiring method	Model code of solenoid set	Model code of solenoid coil
AC	Terminal box type	LA-2※-30	C-LA-2※-30
	DIN connector type	LA-2※-C1-30	C-LA-2※-C1-30
DC	Terminal box type	LD-2P-30 or LD-2P-W-30 *7	C-LD-2P-30
	M12-4-pin connector type	LD-2P-30	C-LD-2P-30

Note: ※: Voltage code (See 7: Solenoid specification table.)
*7 The solenoid model code for DC type with high-pressure specifications (option code "W") is LD-2P-W-30.
○ The solenoid set comprises a solenoid coil, a solenoid cartridge, a plastic nut, and a push pin.
○ DIN connector type solenoid sets and solenoid coils are not provided with a DIN connector socket.
○ When a DIN connector socket is required, order it from your nearest distributor, specifying the model code given in the table below.
Manufacturer: BELDEN

Model code	Power supply voltage	Details	
GDM2011		Without lamp	Without surge killer
GDML2011-LG110-H0	AC 100 V, AC 110 V	With lamp	
GDML2011-LG240-H0	AC 200 V, AC 220 V		
GDML2011-LG110/Z-H0	AC 100 V, AC 110 V		With surge killer
GDML2011-LG220/Z-H0	AC 200 V, AC 220 V		

Terminal box model code

Terminal box type

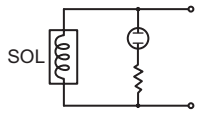
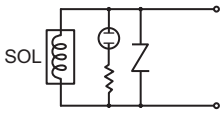
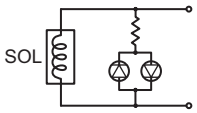
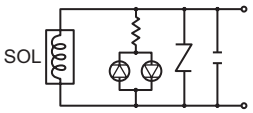
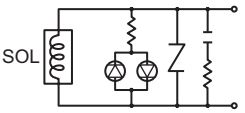
Voltage code	Spool operating method: Type C, N or D				Spool operating method: Type A				Spool operating method: Type B			
	Without surge killer		With surge killer		Without surge killer		With surge killer		Without surge killer		With surge killer	
A	TLW2-AB	(1)	TLW2-A-N	(2)	TLSA2-AB	(1)	TLSA2-A-N	(2)	TLSB2-AB	(1)	TLSB2-A-N	(2)
B			TLW2-B-N				TLSA2-B-N				TLSB2-B-N	
P	TLW2-NP	(3)	TLW2-NP-N	(4)	TLSA2-NP	(3)	TLSA2-NP-N	(4)	TLSB2-NP	(3)	TLSB2-NP-N	(4)
			TLW2-P-NR	(5)			TLSA2-P-NR	(5)			TLSB2-NP-NR	(5)

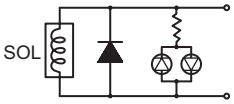
M12-4-pin connector type

Voltage code	Spool operating method: Type C or D		Spool operating method: Type B	
P	TLW2-NP-D3APG-M12	(6)	TLSB2-NP-D3APG-M12	(6)

Note: ○ The number next to each model code indicates the type of the electrical circuit. (See the electrical circuits section for details.)

Electrical circuits
(terminal box type: (1), (4), (5), DIN connector type: (1), (3), M12-4-pin connector type: (6))

AC 100 V or over	AC 100 V or over with surge killer	DC 24 V	DC 24 V With surge killer	DC 24 V With surge killer (with resistance)
(1)	(2)	(3)	(4)	(5)
				

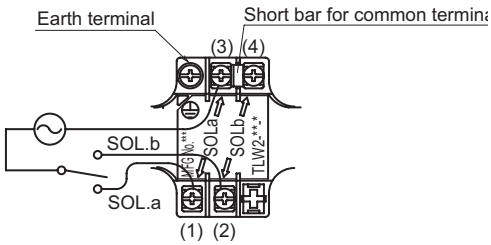
DC 24 V With diode
(6)


Note: ○ When switching a DC solenoid valve with a surge killer through an electromagnetic relay, the reverse surge voltage is suppressed by the varistor and sparks between relay contacts are suppressed by the capacitor at demagnetization of the solenoid.
Standard solenoid valves with a surge killer (option code "N") are very effective to eliminate sparks. However, adequate consideration should be given to the service life of the relay to avoid contact welding due to inrush current at solenoid excitation.
In applications where contact welding due to inrush current is expected, solenoid valves with a surge killer (with resistance) (option code "NR") are effective. Note, however, they are not as effective as standard solenoid valves with a surge killer (option code "N") in terms of elimination of sparks.
○ When using solenoid valves without a surge killer, adequate consideration should be given to protection against the reverse surge voltage generated at demagnetization of the solenoid. (It is advisable to incorporate a surge absorbing element such as a varistor in the circuit.)
○ Be careful about the polarity (+/–) when wiring the terminal box (6) for the M12-4-pin connector type. Carrying current with miswiring will cause short-circuit current to flow into the built-in diode and damage the diode and drive circuit.

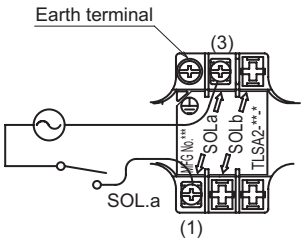
Wiring guide

- The figure shows the status with the terminal box nameplate removed.
- Always turn off the power supply before starting wiring work.
- Use crimp-style terminals for M3.
- For double solenoid type valves, a short bar for common terminals is fitted to facilitate wiring. Connection to either terminal (3) or (4) is sufficient.
- Tighten the terminal screws (M3) at a tightening torque of 0.34 to 0.51 N·m {3.4 to 5.1 kgf·cm}
- There is no polarity even with DC solenoid valves.

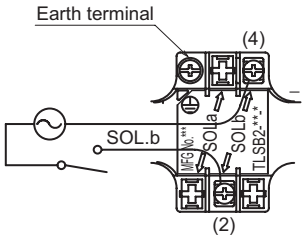
Spool operating method: Type C, N or D
[Terminal box type]



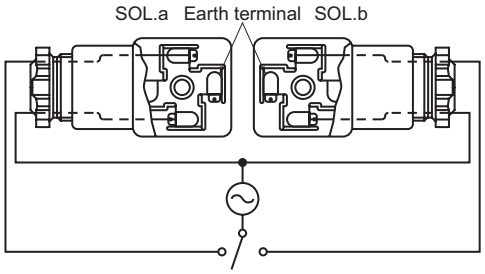
Spool operating method: Type A
[Terminal box type]



Spool operating method: Type B
[Terminal box type]



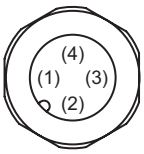
Spool operating method: Type C, N, D, A, B
[DIN connector type]



- Be careful about the polarity (+/–) when connecting the wiring to the M12-4-pin connector type solenoid valve.
  Carrying current with miswiring will cause short-circuit current to flow into the built-in diode and damage the diode and drive circuit.

M12-4-pin connector type

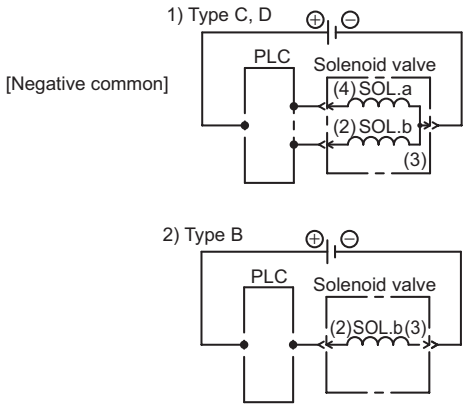
M12-4-pin connector pin-out



●M12-4-pin connector pin-out

(1) DC 24 V (brown)	(3) OV (blue)
(2) SOL.b (white)	(4) SOL.a (black)

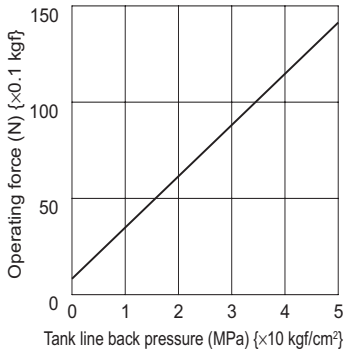
Connector wiring schematic



Handling

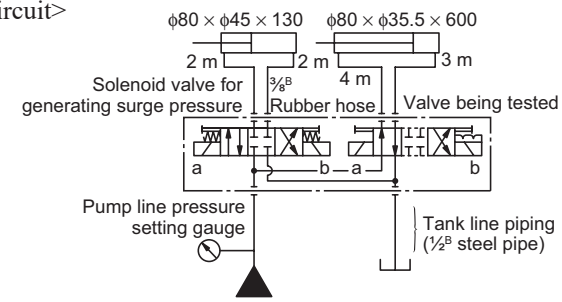
- **Wiring guide for solenoid (AC solenoid valve)**
  Solenoids can be used with both 50 and 60 Hz.
- **No-spring type (with detent)**
  When continuous energizing is not applied with a no-spring type (with detent) solenoid valve, isolate the valve's tank line piping.
  If the tank line piping is connected to a common line rather than an isolated line being provided, the spool may rotate in the reverse direction unexpectedly due to surge pressures generated by switching of other directional control valves. When connecting the tank line to a common line, incorporate a check valve in the tank line or carefully consider the piping length of the tank line by using the example test given below as a guide.
- **Operating force for manual operation pin**
  The force required to operate the manual operation pin varies depending on the back pressure in the tank line.

Operating force for manual operation pin

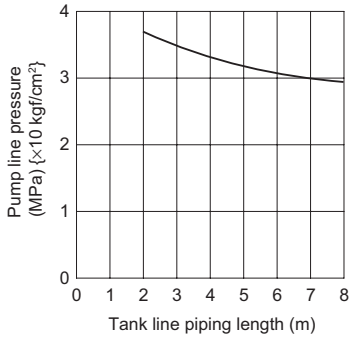


- **Testing withstanding surge pressure of no-spring type (with detent) solenoid valve (example)**
  <Method> Measuring the limit pressure in the pump line where the spool of the valve being tested does not rotate in the reverse direction in the non-energized state when the solenoid valve for generating surge pressure is switched
  <Conditions> Pump line pressure: 3.5 MPa {35 kgf/cm^2}
  Flow rate: 26 L/min

<Circuit>



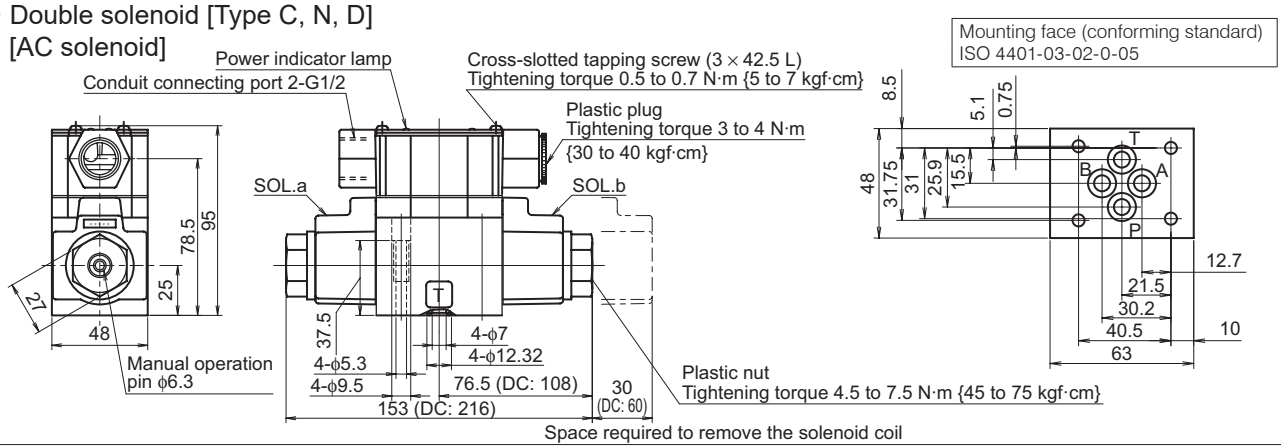
<Result>



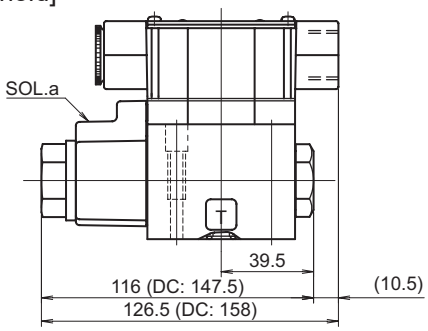
External dimension diagram

■ Terminal box type

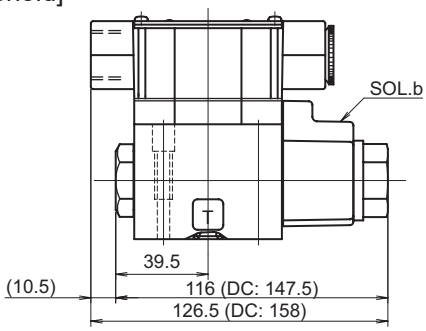
● Double solenoid [Type C, N, D]
[AC solenoid]



● Single solenoid [Type A]
[AC solenoid]



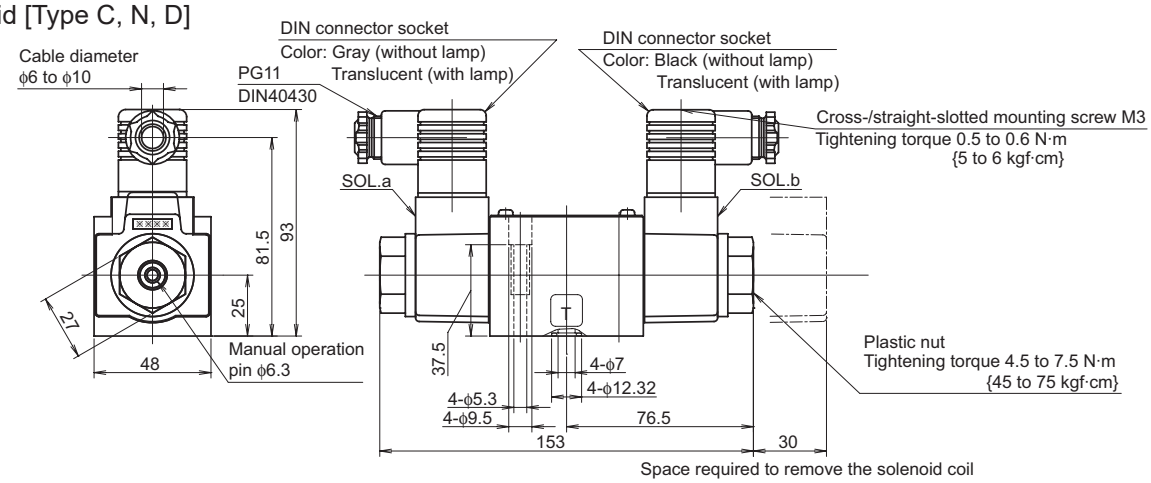
● Single solenoid [Type B]
[AC solenoid]



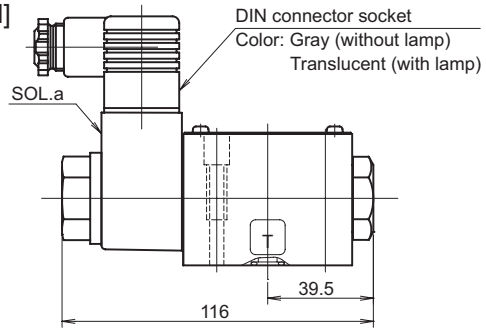
External dimension diagram

■ DIN connector type

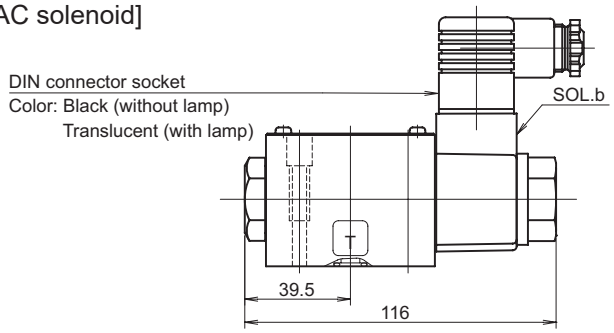
● Double solenoid [Type C, N, D]
[AC solenoid]



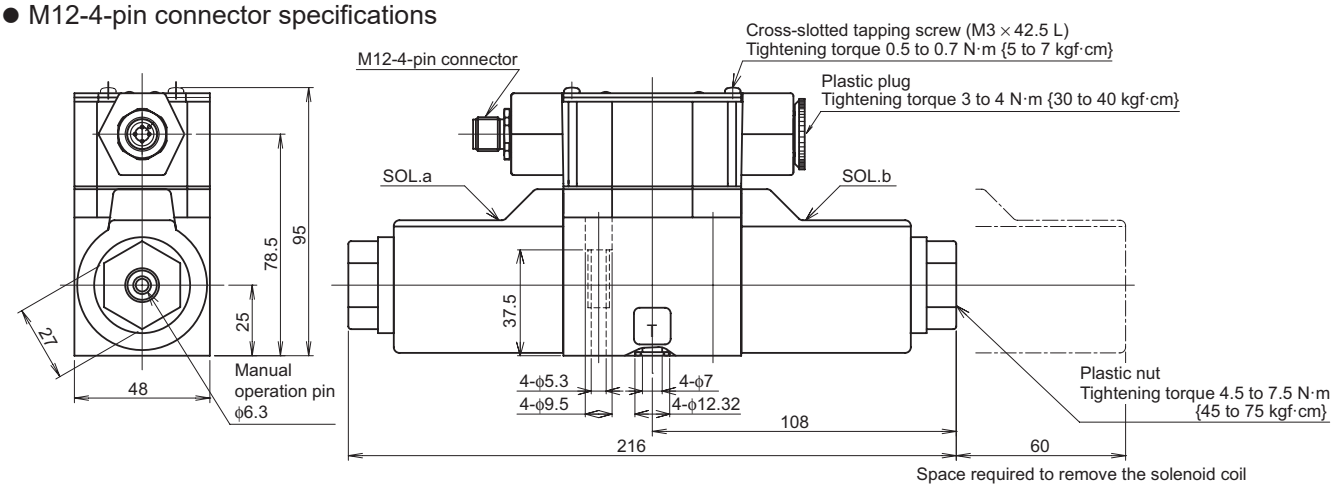
● Single solenoid [Type A]
[AC solenoid]



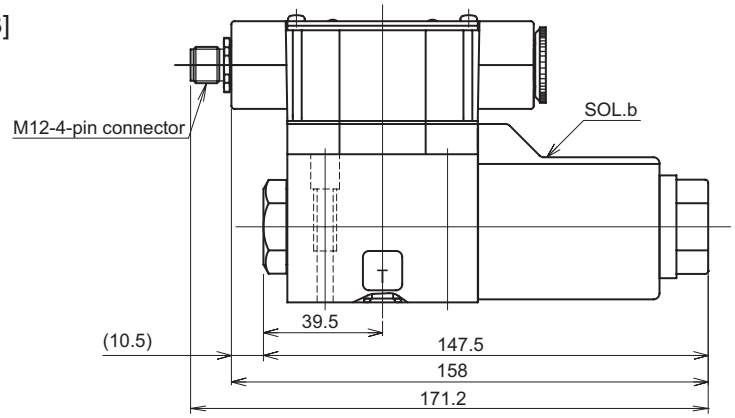
● Single solenoid [Type B]
[AC solenoid]



● M12-4-pin connector specifications

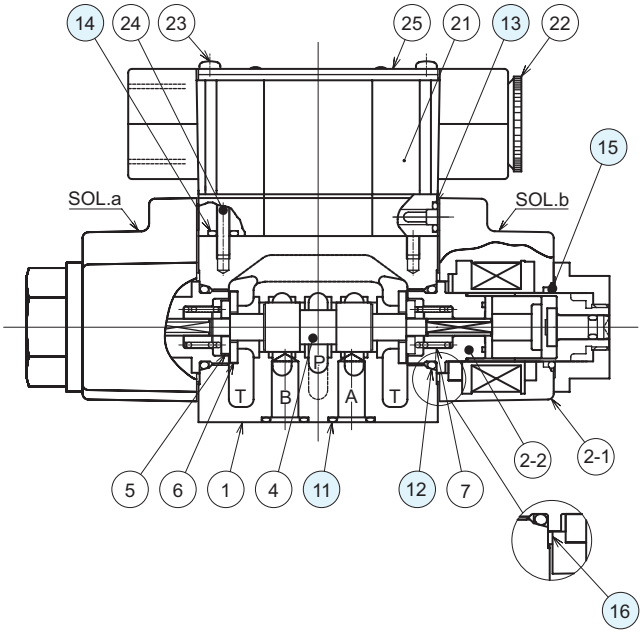


● Single solenoid [Type B]
[DC solenoid]



Sectional structural diagram

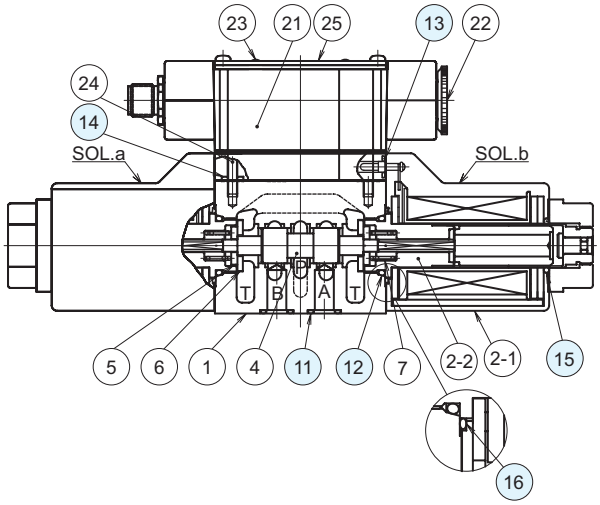
LS-G02
(Terminal box type)



Sealing part table

Part No.	Name	Quantity		Part specifications
		AC	DC	
11	O-ring	4	4	AS568-012 (NBR, Hs90)
12	O-ring	2	2	JIS B 2401 1B P18
13	O-ring	4	4	JIS B 2401 1A P4
14	O-ring	3	3	JIS B 2401 1A P5
15	O-ring	2	–	JIS B 2401 1A P18
		–	2	JIS B 2401 1A P16
16	Sheet packing	2	–	NBR, Hs65
	O-ring	–	2	AS568-021 (NBR, Hs70)

LS-G02
(M12-4-pin connector specifications)



Sealing part table

Part No.	Name	Quantity	Part specifications
11	O-ring	4	AS568-012 (NBR, Hs90)
12	O-ring	2	JIB B 2401 1B P18
13	O-ring	4	JIB B 2401 1A P4
14	O-ring	3	JIB B 2401 1A P5
15	O-ring	2	JIB B 2401 1A P16
16	Sheet packing	2	AS568-021 (NBR, Hs70)