

ASCO™ Spool Valves

single/dual solenoid - pilot operated - aluminium body - 1/4 and 1/2 tapped

3/2 NC
SERIES
551 - 553

Features

- The monostable spool valves in conformity with IEC 61508 Standard (2010 route 2_H version) have TÜV (551 series) and EXIDA (551-553 series) certified with integrity levels: SIL 2 for HFT = 0 / SIL 3 for HFT = 1
- The spool valves 3/2 NC have threaded port connections
- All the exhaust ports of the spool valve are connectable, providing better environmental protection. Particularly recommended for sensitive areas, such as clean rooms, and applications in the pharmaceutical and food processing sectors
- The valves offer environmental protection against the ingress of liquids, dusts or other foreign matter (environmentally-protected construction)
- Ultra low power level for inside application, suitable to connect to process fieldbus remote I/O or valve couplers
- The solenoid valves satisfy all relevant EU directives

General

Differential pressure

2 - 10,4 bar [1 bar = 100 kPa]

Flow (Qv at 6 bar)

1/4 = 860 l/min (ANR)

1/2 = 3800 l/min

fluids (*)	temperature range (TS)	seal materials (*)
air, inert gas, filtered	-25°C to +40°C ^(a)	NBR (nitrile) + PUR (polyurethane)
	-25°C to +60°C	

^(a) With series 302 pilots, prefixes CFSC/CFVT/CFSCIS/CFSCZN.

Materials in contact with fluid

(*) Ensure that the compatibility of the fluids in contact with the materials is verified

Body

Aluminium, black anodised

End cover (spring return)

Glass-filled PA

Spool valve internal parts

Zamak, stainless steel, POM, aluminium

Pilot internal parts

Size 30 (E06.05.80), refer to specific catalogue pages:

314/LPKF (contact us) - 195 (LISC)

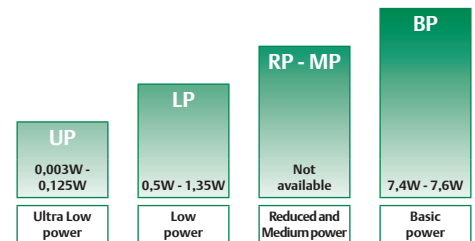
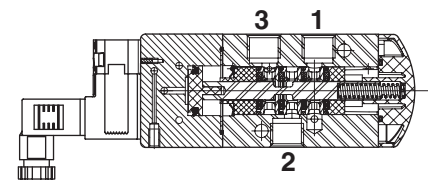
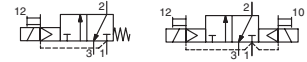
Pilots Size 15 (E06.36.120N), refer to specific catalogue pages:

302 (CFSC/CFVT/CFSCIS/CFSCZN) - 630

piezotronic (PISC-PISCIS)

Aluminium

Pilot end covers



POWER LEVELS - cold electrical holding values (watt)

Specifications

pipe size	orifice size	flow coefficient Kv		operating pressure differential (bar)			power level	prefix optional solenoids						basic catalogue number		
								ATEX / IECEx			IP65			CNOMO size 30	CNOMO size 15	
								min..	max. (PS)		Ex db	Ex ia				Ex nA
(*)	(mm)	(m³/h)	(l/min)		air (*)	~ / =	(1)	LISC	CFSCIS	PISCIS	CFSCZN	CFSC	PISC			
Solenoid air pilot operated - spring return (monostable)																
1/4	6	0,75	12,5	2	10	10	LP	-	-	-	-	○	●	-	-	❖551C505 ⁽²⁾
1/4	6	0,75	12,5	2	-	8	LP	-	-	○	-	-	-	-	-	❖551C505 ⁽²⁾
1/4	6	0,75	12,5	2	10	10	BP	●	-	-	-	-	-	-	-	❖551A205 ⁽²⁾
1/4	6	0,75	12,5	2	-	8	LP	-	○	-	-	-	-	-	-	❖551B205 ⁽²⁾
1/4	6	0,75	12,5	2	8	8	UP	-	-	-	○	-	-	●	-	❖551C505 ⁽²⁾
1/2	13	3,15	52,5	2	10	10	LP	-	-	-	-	○	●	-	-	❖553A505 ⁽²⁾
1/2	13	3,15	52,5	2	-	8	LP	-	-	○	-	-	-	-	-	❖553A505 ⁽²⁾
1/2	13	3,15	52,5	2	10	10	BP	●	-	-	-	-	-	-	-	❖553A205 ⁽²⁾
1/2	13	3,15	52,5	2	-	8	LP	-	○	-	-	-	-	-	-	❖553A205 ⁽²⁾
1/2	13	3,15	52,5	2	8	8	UP	-	-	-	○	-	●	-	-	❖553A505 ⁽²⁾

❖ Select 8 for NPT ANSI 1.20.3 or select G for ISO G (228/1) ● Available feature ○ Available feature in DC only. - Not available

⁽¹⁾ 314/LPKF: Contact us

⁽²⁾ Certified IEC 61508 Functional Safety data, use suffix "SL".

Specifications

pipe size	orifice size	flow coefficient Kv		operating pressure differential (bar)			power level	prefix optional solenoids						basic catalogue number		
								ATEX / IECEx			IP65					
				min..	max. (PS)			Ex db	Ex ia		Ex nA	CFSC	PISC	CNOMO size 30	CNOMO size 15	
(❖)	(mm)	(m³/h)	(l/min)		air (*)	~ / =	(1)	LISC	CFSCIS	PISCIS	CFSCZN	CFSC	PISC			
Solenoid air pilot operated and return (bistable)																
1/4	6	0,75	12,5	2	10	10	LP	-	-	-	-	○	●	-	-	❖551C506
1/4	6	0,75	12,5	2	-	8	LP	-	-	○	-	-	-	-	-	❖551C506
1/4	6	0,75	12,5	2	10	10	BP	●	-	-	-	-	-	-	-	❖551A206
1/4	6	0,75	12,5	2	-	8	LP	-	○	-	-	-	-	-	-	❖551B206
1/4	6	0,75	12,5	2	8	8	UP	-	-	-	○	-	●	-	-	❖551C506
1/2	13	3,15	52,5	2	10	10	LP	-	-	-	-	○	●	-	-	❖553A506
1/2	13	3,15	52,5	2	-	8	LP	-	-	○	-	-	-	-	-	❖553A506
1/2	13	3,15	52,5	2	10	10	BP	●	-	-	-	-	-	-	-	❖553A206
1/2	13	3,15	52,5	2	-	8	LP	-	○	-	-	-	-	-	-	❖553A206
1/2	13	3,15	52,5	2	8	8	UP	-	-	-	○	-	●	-	-	❖553A506

❖ Select 8 for NPT ANSI 1.20.3 or select G for ISO G (228/1) ● Available feature ○ Available feature in DC only. - Not available

Prefix table

prefix						description	power level			
1	2	3	4	5	6		UP	LP	RP	BP
CNOMO solenoid (pilot) interface size 30										
L	I	S	C			Intrinsically safe - 195 pilot (EN/IEC 60079-11)*	-	○	-	-
						(1)Flameproof - Aluminium - 314/LPKF pilot (EN/IEC 60079-1, 60079-31)*	-	-	-	●
CNOMO solenoid (pilot) interface size 15										
C	F	S	C			Solenoid + spade plug AMP 2,5x0,5, 9,4 mm, (EN 60730), 302 pilot	-	●	-	-
C	F	V	T			Solenoid with M12 connection, LED + protection (EN 60730), 302 pilot	-	○	-	-
C	F	S	C	I	S	Intrinsically safe, 9,4 mm, pilot 302; ATEX (EN/IEC 60079-11, -26)*	-	○	-	-
C	F	S	C	Z	N	Non sparking, connector 9,4 mm cable 2 m, pilot 302 (EN 60079-15, -31)*	-	○	-	-
P	I	S	C			Solenoid with spade plug connector (EN 60730), 630 piezotronic pilot	●	-	-	-
P	I	S	C	I	S	Intrinsically safe, piezotronic 630 pilot, ATEX (EN/IEC 60079-11, -26)*	○	-	-	-

Product selection guide

STEP 1
Select basic catalogue number, including pipe thread identification letter. Refer to the specifications table on page: 1 or 2

Example: G553A505

STEP 2

Select prefix (combination). Refer to the specifications table and the prefix table, respect the indicated power level.

Example: CFSC

STEP 3

Select suffix. Refer to the suffix table, respect the indicated power level. Suffix MO mandatory for the pilot 302 (CFSCIS/CFSDIS/CFVTIS/CFSCZN/CFVTZN).

Example: MO

STEP 4

Selection of TPL is mandatory for the 630 pilot (PISCIS), 12 HV DC (32 mW) and 24 HV DC (125 mW). Add "X" between the prefix "PISCIS" and the basic catalogue number.

STEP 5

Select voltage. Refer to standard voltages on page: 3

Example: 230V / 50Hz

STEP 6

Final catalogue / ordering number

Example:

CFSCG553A505MO 230 V / 50 Hz

Suffix table

suffix						description	power level			
1	2	3	4	5	6		UP	LP	RP	BP
CNOMO solenoid (pilot) interface size 30										
				M	S	Screw type manual operator (2)(3)	-	-	-	●
		S	L			Certified IEC 61508 Functional Safety data (4)	-	○	-	●
CNOMO solenoid (pilot) interface size 15										
				M	S	Screw type manual operator (2)	-	●	-	-
				M	O	Push type manual operator	○/●	○/●	-	-
S	L					Certified IEC 61508 Functional Safety data (4)	○/●	○/●	-	-

Options & Accessories

series	pipe size	exhaust protector (stainless steel)		
		(G)	(NPT)	-
551/553	1/8	34600418 (5)	34600482 (5)	-
551	1/4	34600419 (5)	34600483 (5)	-
553	1/2	34600479 (5)	34600481 (5)	-
551/553	M5	-	-	34600484 (5)

- Available feature
- Available feature in DC only
- Not available
- * ATEX/IECEx valves using these solenoids are approved according to EN ISO 80079-36 (2016) and EN ISO 80079-37 (2016) [non electrical]
- (1) 314/LPK: Contact us
- (2) Not to use with SL suffix
- (3) Not to use with LISC prefix
- (4) Not to use with MS suffix
- (5) Provided with "SL" suffix

Ordering examples valves:

LISC	G	551	B	205				12..24V / DC
CFSC	G	553	C	506				230V / 50 Hz
CFSC	8	553	C	505	MO			230V / 50 Hz
CFSC	G	553	C	505	SLMO			230V / 50 Hz
CFVTZN	G	551	C	505				24V / DC
PISCIS	G	551	C	506	MO			6V / DC
PISCIS	G	551	C	505	SLMO			6V / DC
PISCIS X	G	551	C	505	MO	TPL20666		24HV / DC

prefix — pipe thread — basic number — voltage — TPL — suffix

Explanation of temperature ranges of solenoid valves

Valve temperature range	The valve temperature range (TS) is determined by the selected seal material, the temperature range for proper operation of the valve and sometimes by the fluid (e.g. steam)
Operator ambient temperature range	The operator ambient temperature range is determined by the selected power level and the safety code
Total temperature range	The temperature range of the complete solenoid valve is determined by the limitations of both temperature ranges above

Electrical characteristics

Coil insulation class
Electrical safety
Standard voltages

F
IEC 335
DC (=) ⁽⁸⁾: 24V - 48V ; CFSC/CFSCZN/CFVT: 24V
CFSCIS: 12V - 24V ; LISC: 12..24V, PISC: 24V to 70V ; PISCIS: 6V, 8V, 12V, 24V
AC (~) ⁽⁸⁾: 24V - 48V - 115V - 230V/50Hz ; CFSC: 24V - 115V - 230V/50Hz ;
PISC: 24V to 70V - other voltages and 60Hz are available on request

prefix option	power ratings				operator ambient temperature range (TS) (C°)	safety code	electrical enclosure protection (EN 60529)	replacement coil		type (2)
	inrush ~ (VA)	holding ~ (VA)	hot/cold = (W)	hot/cold = (W)				~	=	
Basic power (BP) ⁽⁸⁾	8,6	1,6	7,4	6/7,6	-25 to +80	II2G Ex db IIB+H2 Gb T4, II2D Ex tb IIIC Db	IP66/67, alu.	-	-	01
Low Power (LP)										
CFSC	1,4	1,2	1,1	1/1,2	-25 to +60	EN 60730	IP65, moulded	-	-	03
CFSC	2,1 ⁽⁷⁾	1,6 ⁽⁷⁾	1,5 ⁽⁷⁾	-	-25 to +60	EN 60730	IP65, moulded	-	-	03
CFVT ⁽⁶⁾	-	-	-	1,15/1,35	-25 to +60	EN 60730	IP65, moulded	-	-	04
CFSCZN	-	-	-	1/1,2	-25 to +40/55/60	II 3G Ex nA IIC T6/T5/T4 Gc, II 3D Ex tc IIIC Dc	IP65, moulded	-	-	06
CFSCIS ⁽⁴⁾⁽⁵⁾	-	-	-	0,5	-10 to +40/60	II 2G Ex ia IIC T6/T4 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	07
LISC ⁽³⁾⁽⁴⁾	-	-	-	0,5	-40 to +65	II 2G Ex ia IIC T6 Ga, II 2D Ex ib IIIC Db ⁽³⁾	IP65, moulded	-	-	02
Ultra low power (UP)										
PISC	-	-	-	0,007	0 to +60	-	IP65, moulded	-	-	05
PISCIS ⁽¹⁾⁽⁴⁾ 6V	-	-	-	0,003	-20 to +50	II 2G Ex ia IIC T6 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	05
PISCIS ⁽¹⁾⁽⁴⁾ 8V	-	-	-	0,022	-20 to +50	II 2G Ex ia IIC T6 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	05
PISCIS ⁽¹⁾⁽⁴⁾ 12LV	-	-	-	0,012	-20 to +50	II 2G Ex ia IIC T6 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	05
PISCIS ⁽¹⁾⁽⁴⁾ 12HV	-	-	-	0,032	-20 to +50	II 2G Ex ia IIC T6 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	05
PISCIS ⁽¹⁾⁽⁴⁾ 24LV	-	-	-	0,046	-20 to +50	II 2G Ex ia IIC T6 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	05
PISCIS ⁽¹⁾⁽⁴⁾ 24HV	-	-	-	0,125	-20 to +50	II 2G Ex ia IIC T6 Ga, II 2D Ex ia IIIC Da	IP65, moulded	-	-	05

⁽¹⁾ Piezotronic standard voltages:

PISC prefix, 24 V to 70 V AC/DC, peak current max.: 80 mA, holding current max.: 1 mA

PISCIS prefix:	6 V DC / 3 mW	8 V DC / 22 mW	12 LV DC / 12 mW	12 HV DC / 32 mW	24 LV DC / 46 mW	24 HV DC / 125 mW
Turn ON voltage U _{ON}	6..9 V	7,2..12 V	10,8..16 V	10,8..16 V	21,6..28 V	21,6..28 V
Turn OFF voltage U _{OFF}	3 V	3,2 V	3,3 V	3,3 V	5 V	5 V
Peak current	6 mA	10 mA	6,8 mA	8,1 mA	10 mA	14 mA
Holding current	0,5 mA	2,8 mA	1 mA	2,7 mA	1,9 mA	5,2 mA
Cable + max. barrier resistances (R _s + R _c)	1200 Ω max.	300 Ω max.	1200 Ω max.	470 Ω max.	1200 Ω max.	470 Ω max.

prefix option	safety parameters				
	U _I (= DC) (V)	I _I (mA)	P _I (W)	L _I (H)	C _I (µF)
Low Power (LP)					
CFSCIS	28	300	1,6	0	0
LISC	30	300	1,6	0	0
Ultra low power (UP)					
PISCIS	30	200	0,9	0	0

⁽²⁾ Refer to the dimensional drawings on pages: 4 to 7

⁽³⁾ Min. operating current (I_{(ON) min.}): 0,036 A / U_{(ON) min.} = 12,8 V (For use in zone 0 locations, see the installation conditions given in the I&M instructions)

⁽⁴⁾ Intrinsically safe pilots: Check the electrical characteristics in the corresponding catalogue pages (CFSCIS/LISC/PISCIS: 302/19500036/630 pilots).

⁽⁵⁾ CFSCIS (302 pilots):

12 V: I_{(ON) min.} with LED = 33 mA; U_{(ON) min.} = 11,9 V; U_(max.) recommended = 23 V; U_{(OFF) = 3,3 V; I_{(OFF) = 10 mA}}

24 V: I_{(ON) min.} with LED = 25 mA; U_{(ON) min.} = 16,4 V; U_(max.) recommended = 28 V; U_{(OFF) = 5,7 V; I_{(OFF) = 7 mA}}

⁽⁶⁾ Values for LED + protection.

⁽⁷⁾ AC: 230V

⁽⁸⁾ 314/LPK: Contact us

- Not available

Electrical connections

prefix	connection
⁽⁸⁾	1/2" NPT threaded cable entry. Enclosures are supplied without cable gland
LISC	Spade plug connector with cable gland EN175301-803A (ISO 4400) for cables with an outer diameter from 6 to 8 mm
CFSC, CFSCIS, PISC, PISCIS	Spade plug connector with cable gland DIN 43650, 9,4 mm, form C, for cables with an outer diameter from 4 to 6 mm
CFSCZN	Spade plug connector, DIN 43650, 9,4 mm, form C, pre-wired connector length 2 m
CFVT	M12 connection for M12 connector
CFL	Moulded-in flying lead, standard length 0,3 m


Additional options

- TPL numbers: TPL 20665: Piezotronic, PISCIS prefix, 12 HV (32 mW); TPL 20666: Piezotronic, PISCIS prefix, 24 HV (125 mW)
TPL 20674: LED and protection, CFSC prefix, only available in 24 V AC/DC and 115 V AC - Add 0,15 W (DC) and 0,4 W/VA (AC)
- Other pipe threads are available on request

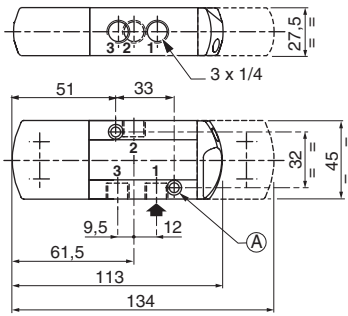
Installation

- Multi language installation/maintenance instructions are included with each valve
- The valves can be mounted in any position without affecting operation
- Do not connect the pressure supply to the exhaust port 3. The "environmentally-protected" construction is not adapted for a "distributing" function or use in NO function. Contact us for functions available in specific versions
- IEC 61508 Functional Safety (suffix SL). Check temperature range of valve body and solenoid for suitability. For probability of failure, contact us
- It is necessary to connect pipes or fittings to the exhaust ports to protect the internal parts of the spool valve and its pneumatic operator if used outside or in harsh environments (dusts, liquids etc.)
- Threaded pipe connection identifier is 8 = NPT (ANSI 1.20.3); G = G (ISO 228/1)
- Valves with suffix "SL" are provided with specific exhaust protectors

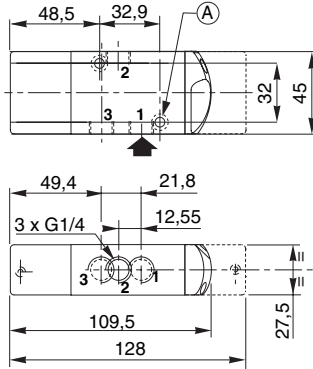
**3/2 NC
SERIES
551 - 553**

Dimensions (mm), Weight (kg) 

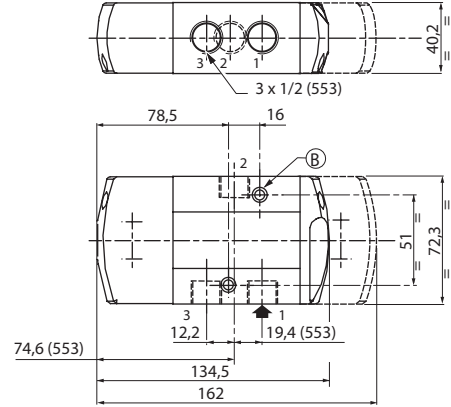
Types: 01 - 02
(551 Series)



Types: 03 .. 07
(551 Series)



Types: 01 .. 07
(553 Series)



Ⓐ 2 mounting holes: 5,3 mm dia.;
Spotfacing: 9 mm dia., depth 5 mm

Ⓑ 2 mounting holes: 6,5 mm dia.;
Spotfacing: 11 mm dia., depth 6 mm



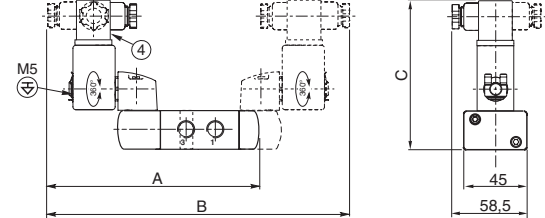
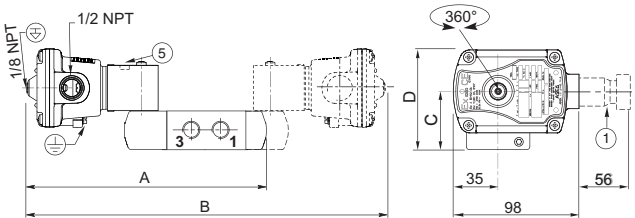
TYPE 01:
314 pilot/LPKF operator
EN/IEC 60079-1, 60079-31

551/553: Contact us



TYPE 02:
Aluminium
195/LISC: EN 60079-11

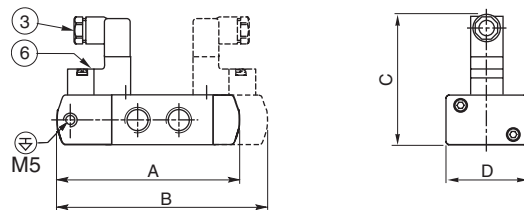
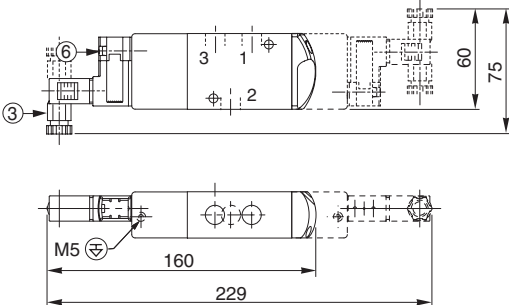
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553A205 / A206



TYPE 03:
Polyarylamide
302 pilot
CFSC: IEC 335 / DIN 43650

551C505 / 551C506
551C505MS / 551C505MO / C506MS / C506MO

553A505 / A505MS / A505MO / A506 / A506MS / A506MO



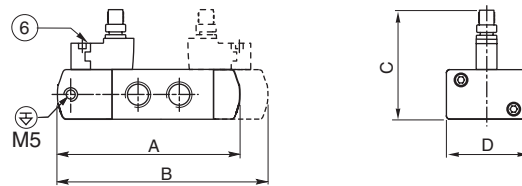
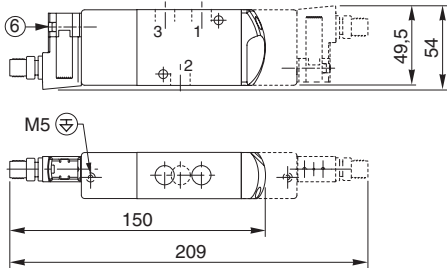
Dimensions (mm), Weight (kg)



TYPE 04:
Polyarylamide
302 pilot
CFVT: IEC 335 / M12 connection + LED and protection

551C505 / 551C506
551C505MS / 551C505MO / C506MS / C506MO

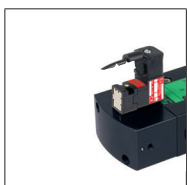
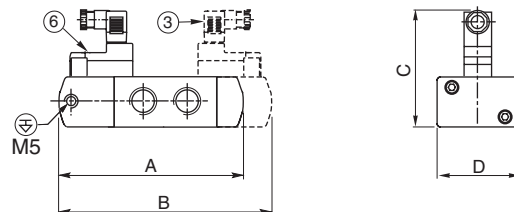
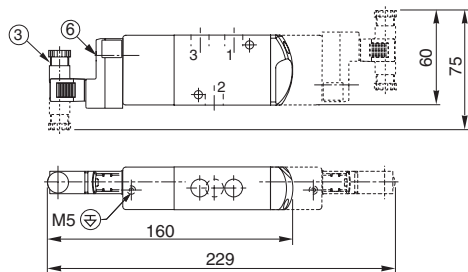
553A505 / A505MS / A505MO / A506 / A506MS / A506MO



TYPE 05:
Polyamide
Piezotronic pilot
PISC: IEC 335 / DIN 43650
PISCIS: EN/IEC 60079-11, 60079-26

551C505MO / 551C506MO

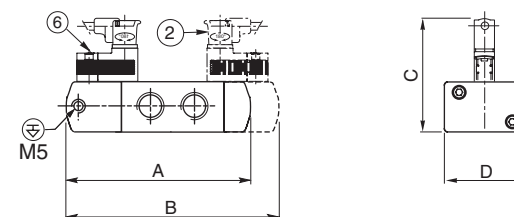
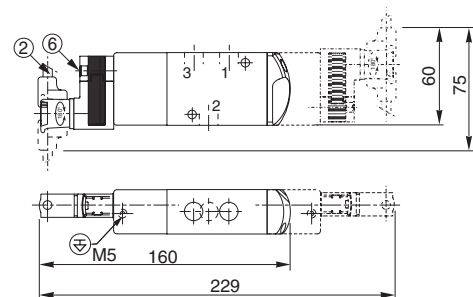
553A505MO / A506MO



TYPE 06:
Polyarylamide
302 pilot
CFSCZN: EN 60079-15, 60079-31

551C505MO / 551C506MO

553A505MO / A506MO



**3/2 NC
SERIES
551 - 553**

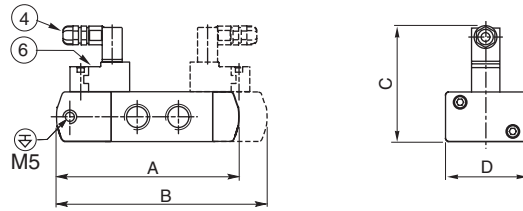
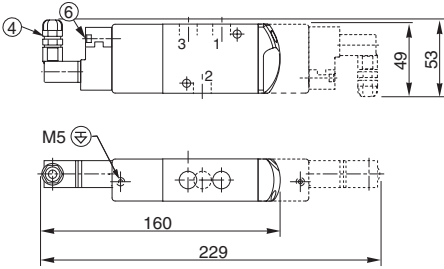
Dimensions (mm), Weight (kg)



TYPE 07:
Polyarylamide
302 pilot
CFSCIS: EN/IEC 60079-11, 60079-26

551C505MO / 551C506MO

553A505MO / A506MO



- ① Ex d certified cable gland (on request)
- ② Three-core cable, length 2 m
- ③ Connector rotatable by 90° increments, cable Ø 4 - 6 mm
- ④ Connector rotatable by 90° increments, cable Ø 6 - 8 mm
- ⑤ Screw type manual operator, suffix MS

- ⑥ Push type manual operator, suffix MO
- ⊕ Connectable pilot exhaust port

type	prefix/option	power level	A		B		C		D		weight ⁽¹⁾			
											monostable		bistable	
			551	553	551	553	551	553	551	553	551	553	551	553
01	314/LPKF ⁽²⁾	BP	185	219,5	278	330	43	55,7	74	86,7	1,19	1,94	1,93	3,02
02	LISC	LP	164	204,5	236	284	107	116,5	45	72,3	0,59	1,34	0,80	2,42
03	CFSC	LP	-	134,5	-	162	-	90,2	-	72,3	0,33	1,00	0,38	2,08
04	CFVT	LP	-	134,5	-	162	-	79,2	-	72,3	0,33	1,00	0,38	2,08
05	PISC / PISCIS	UP	-	134,5	-	162	-	90,2	-	72,3	0,31	1,00	0,32	2,08
06	CFSCZN	LP	-	134,5	-	162	-	90,2	-	72,3	0,41	1,08	0,54	2,24
07	CFSCIS	LP	-	134,5	-	162	-	91,2	-	72,3	0,34	1,02	0,4	2,12

⁽¹⁾ Incl. coil(s) and connector(s).
⁽²⁾ 314/LPK: Contact us

Accessories

ØA	M5	1/8	1/4	3/8	1/2
B	4,5	-	11	11	14

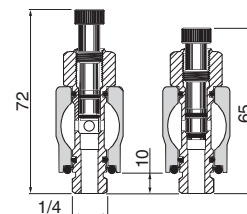
**exhaust protector
(stainless steel)**

Accessories (551 Series)

Supply rail (supplied with seals and banjo bolts, without mounting brackets)		
supply rail for "n" valves	catalogue number	
	G 1/4	NPT 1/4
2	88100034	88100053
3	88100035	(1)
4	88100036	88100054
5	88100037	88100058
6	88100038	88100055
7	88100039	88100059
8	88100040	88100060

(1) Available on request.

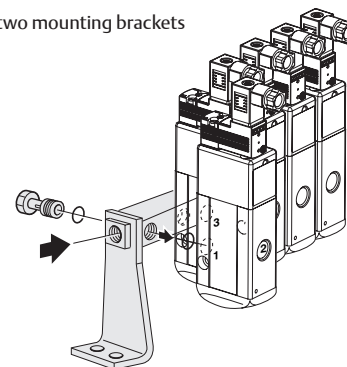
supply rail with isolation valves with mounting brackets (Allows the isolation of one or more valves from the general pressure supply)		
supply rail for "n" valves	catalogue number	
	G 1/4	NPT
2	88100915	-
3	88100916	-
4	88100917	-
5	88100918	-
6	88100919	-
7	88100920	-
8	88100921	-
9	88100922	-
10	88100923	-
11	88100924	-
12	88100925	-



551 Series	number of valves							
	2	3	4	5	6	7	8	
A	108	136	164	192	220	248	276	
B	92	120	148	176	204	232	260	
C	55	83	111	139	167	195	223	
D	78	106	134	162	190	218	246	
E	42	70	98	126	154	182	210	
type	weight (kg)							
03, monostable/bistable	0,9/1	1,2/1,4	1,5/1,9	1,9/2,3	2,2/2,7	2,5/3,1	2,8/3,5	
04, monostable/bistable	0,9/1	1,2/1,4	1,5/1,9	1,9/2,3	2,2/2,7	2,5/3,1	2,8/3,5	
05, monostable/bistable	0,86/0,92	1,94/1,28	1,42/1,74	1,8/2,1	2,08/2,46	2,36/2,82	2,64/3,18	
06, monostable/bistable	0,9/1	1,2/1,4	1,5/1,9	1,9/2,3	2,2/2,7	2,5/3,1	2,8/3,5	
07, monostable/bistable	0,92/1,02	1,23/1,46	1,54/1,98	1,95/2,4	2,26/2,82	2,57/3,24	2,88/3,66	

mounting brackets (2)	
series	catalogue number
551	88100049

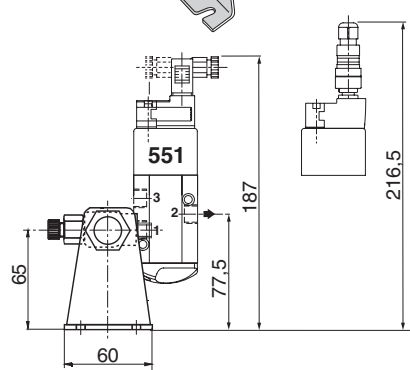
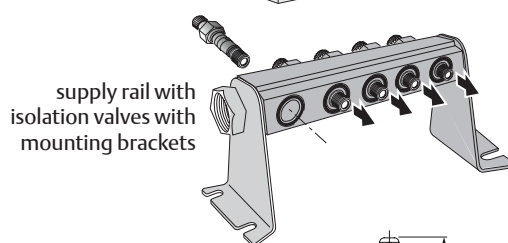
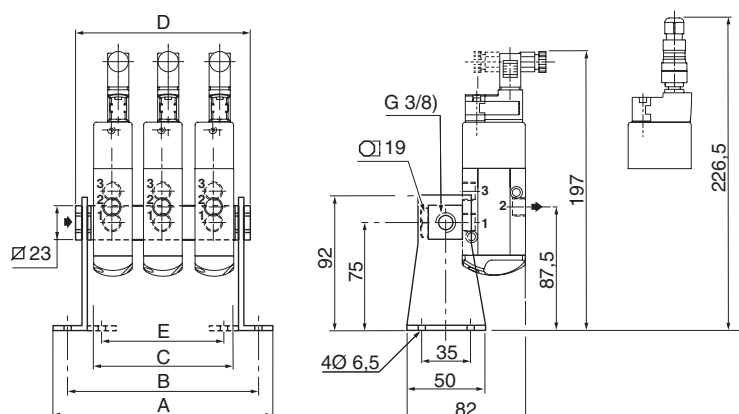
(2) Set of two mounting brackets



Dimensions (mm), Weight (kg)

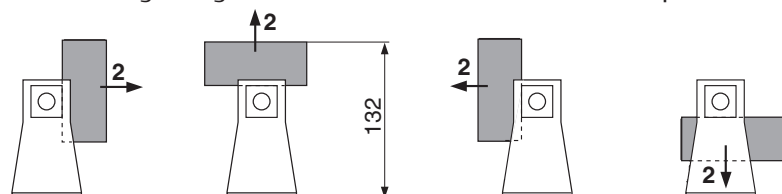


TYPES: 03..07



Supply rail with isolation valves

This mounting arrangement allows valves to be mounted in the positions below.



Not possible with
supply rail and
isolation valves

Only with supply rail
with isolation valves

