

HANDBOOK
EXPANSION VALVES

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 **Castel**[®]
Italian technology

CHAPTER 11 ■ “SMART CONNECTOR” SYSTEM



APPLICATIONS

The “SMART CONNECTOR” systems series 9910 are formed by coupling a connector in series 9152, equipped with an integrated electronic circuit in the connector, with a specific series 9300 coil designed for the connector. These systems have been designed by Castel to be installed on:

- Normally-closed solenoid valves in series 1024, 1028, 1034, 1038, 1040, 1048, 1050, 1058, 1059, 1064, 1068, 1070, 1078, 1079, 1090, 1098 and 1099
- Solenoid expansion valves in series: 2028, 2028N, 2028R, and 2028E, if suitably sized to have opening / closing cycles with a frequency greater than 0.6 seconds.

and allow:

- a reduction in energy consumption when fully operational
- a consequent reduction in the operating temperature
- an extension of the coil life
- an increase in the MOPD value

N.B.: Castel does not sell the two parts (coil and connector) that make up a “SMART CONNECTOR” system separately.

CONNECTION CONSTRUCTION

EN 175301-803 (former DIN 43650) standardized connectors 9152 represent an effective system for the connection of the coil to the power system, thus ensuring safety also in the presence of moisture.

Connectors 9152 are available in both the direct current version (with 12 VDC and 24 VDC voltages) and in the alternating current version (with 24 VAC or 220/240 VAC voltages).

The direct current versions are equipped with polarity inversion protection.

The alternating current versions are equipped with a bridge rectifier circuit integrated on the circuit.

All versions, both direct current and alternating current, are equipped with a diode device that guarantees surge protection. All versions have the voltage for use and the wiring diagram printed on the casing. The gland nut of the outer casing is suitable for receiving cables with an external diameter of 6 to 9 mm and is equipped with a self-locking device. It is recommended that three-pole cables with a cross-section greater than or equal to 0.75 mm² be used. There are no versions with co-moulded cables.

Each connector in a “SMART CONNECTOR” system must be used only for the type of coil with which it is coupled in the system. Incorrect use of the connector with other types of coils produced by Castel will quickly damage the coil and the connector.

COIL CONSTRUCTION

Coils in series HF2 (9300) used in the “SMART CONNECTOR” systems are special coils available in both the direct current version (with 12 VDC and 24 VDC voltages) and rectified current version (with 24 VRAC, 220 VRAC, or 240 VRAC).

These coils are in Class H, in accordance with IEC standard 85 and their production is compliant with standards EN 60730-1 and EN 60730-2-8. The windings are made of enamelled copper wire, with insulation class H (180 °C), in compliance with IEC standard 85. The terminals of the coils consist of two Faston connectors plus a Faston ground connector. The outer casing is made of waterproof, dielectric resins that guarantee reinforced insulation and allow any type of assembly.

They have Class I protection ratings against electric contacts. Consequently, their safety requires an efficient ground system. A rubber gasket assembled on the lower end of the coil completes the protection of the windings from humidity. When coupled with connectors 9152, these coils guarantee an IP65 protection rating according to standard EN 60529.

The coils are designed for continuous use. The solid construction of these coils makes them suitable for use in refrigeration systems operating in heavy-duty environments. The maximum ambient temperature for all coils is 50 °C.

Each coil in a “SMART CONNECTOR” system must be used only in combination with the type of connector with which it is coupled in the system. Incorrect use of the coil with other types of connectors produced by Castel will quickly damage the coil and the connector.

OPERATION

Through the integrated circuit in the connector, and coupling with the specific coil, connectors 9152 are capable of improving the MOPD characteristics of Castel solenoid expansion valves, reducing the power consumption by up

to 50% over time, extending the coil life, and decreasing the noise.

The integrated circuit located inside the connector works in different modes based on the power supply voltage. Specifically, there are two main families with different operating logics.

Connectors 9152/RD (direct current) supercharge the dedicated coil 9300 to its maximum allowed power for a short, pre-set interval. This is called the “Boost” time. It generates a greater attraction force on the valve’s magnetic unit, and consequently increases the MOPD value. At the end of the “Boost” phase, during normal operation, connectors 9152/RD maintain the electric consumption of the dedicated coil 9300 at a lower value, from 45% to 55% lower than the power absorbed by the coil. The power reduction occurs by powering the coil with a high-frequency pulsed current (ON/OFF cycles), from 15 to 30 kHz. This frequency is aimed at guaranteeing the minimum magnetic force to keep the valve open during operation.

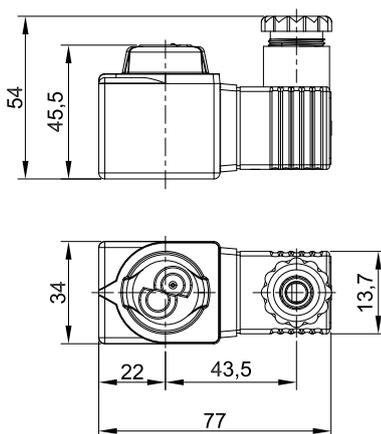
Connectors 9152/RA (alternating current) supercharge the coils 9300 for a pre-set interval. This is called the “Boost” time. It generates a greater attraction force on the valve’s magnetic unit, and consequently increases the MOPD value. Once this period is over, the electronics remove one phase wave every second one, with an effect comparable to powering the coil with pulsed/rectified current with a frequency half of that of the network. By using this system, you obtain an electric power consumption reduction of the unit to a value from 35% to 45%, while maintaining the

minimum magnetic force that allows the valve to be opened. This operating logic makes the “Smart Connector” system powered in alternating current very quiet, reducing the normal noise level, which can be up to 13 dB, to values less than 4 dB based on the valve installation.

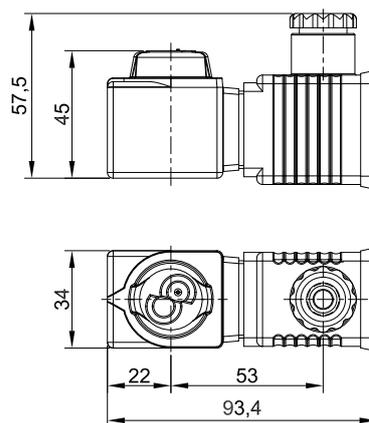
Using the afore-mentioned logic, it is possible to significantly reduce the electricity consumption (which can be important considering the system of refrigerator aisles in a supermarket). Also, it leads to a lower operating temperature of the coil and therefore, in conclusion, less wear on the electromechanical drive system. Obviously, these reductions in consumption are strictly related to the use of the coils. For proper evaluation of the real energy savings, it is necessary to consider the number of coil interventions with respect to the normal power supply time of the valve. If the number of interventions is reduced, the consumption is reduced; if the number of interventions increases, the consumption grows. Table 49 shows the main characteristics of the “SMART CONNECTOR” systems. Table 50 indicates the MOPD values that can be attained by the solenoid expansion valves produced by Castel if coupled with the various models of the “SMART CONNECTOR” system.

CERTIFICATIONS

All connectors and coils in this chapter comply with the Electromagnetic Compatibility (EMC) Directive (2004/108/EC). The connectors with 220/240 VAC voltage and the coils with 220 VRAC and 240 VRAC voltage comply with the Low Voltage Directive (2006/95/EC).



9910/RD



9910/RA

TABELLA 49: General characteristics of systems SMART CONNECTOR

Catalogue Number	Voltage [V]	Voltage tolerance [%]	Frequency [Hz]	Working nominal power [W]	Nominal power tolerance [%]	Insulation class IEC 85	TA [°C]		Boost Time [msec]	Protection degree
							min	max		
9910/RD1 (1)	12 VDC	+/-10	-	3	+/-10	H	-20	+50	130	IP65
9910/RD2 (1)	24 VDC	+/-10	-	5	+/-10	H	-20	+50	130	IP65
9910/RA2	24 VAC	+/-10	50/60	7	+/-10	H	-20	+50	200	IP65
9910/RA6	220 VAC	+/-10	50/60	7	+/-10	H	-20	+50	200	IP65
9910/RA7	240 VAC	+/-10	50/60	7	+/-10	H	-20	+50	200	IP65

(1): Warning if these connectors are supplied via unidirectional direct current or rectified by means of the Graetz bridge, they could not perform a correct cycle of operation but always remain in Boost conditions, leading to fast damage of the

coil. For correct operation the kits series 9910/RD MUST be powered by direct current stabilized or rectified.

TABELLA 50: PWM expansion valves with SMART CONNECTOR: MOPD values [bar]

PWM Valves Codes				SMART CONNECTOR										
				9910/RD1	9910/RD2	9910/RA2	9910/RA6	9910/RA7	Codes					
Refrigerants				12 VDC	24 VDC	24 VAC	220 VAC	240 VAC	Voltage [V]					
HCFC - HFC - HFO	R23	HFC - HC - HFO	R744						Frequency [Hz]					
2028/3S01	2028R/3S01	2028N/3S01	-	37	37	37	37	37						
2028/M10S01	2028R/M10S01	2028N/M10S01												
2028/3S02	2028R/3S02	2028N/3S02												
2028/M10S02	2028R/M10S02	2028N/M10S02												
2028/3S03	2028R/3S03	2028N/3S03												
2028/M10S03	2028R/M10S03	2028N/M10S03												
2028/3S04	2028R/3S04	2028N/3S04												
2028/M10S04	2028R/M10S04	2028N/M10S04												
2028/3S05	2028R/3S05	2028N/3S05												
2028/M10S05	2028R/M10S05	2028N/M10S05												
2028/3S06	2028R/3S06	2028N/3S06												
2028/M10S06	2028R/M10S06	2028N/M10S06												
2028/4S07	2028R/4S07	2028N/4S07												
2028/M12S07	2028R/M12S07	2028N/M12S07												
2028/4S08	2028R/4S08	2028N/4S08								32	32			
2028/M12S08	2028R/M12S08	2028N/M12S08												
2028/4S09	2028R/4S09	2028N/4S09								22	22	32	32	32
2028/M12S09	2028R/M12S09	2028N/M12S09												
-	-	-								2028E/3S00	37	37	37	37
			2028E/M10S00											
			2028E/3S01											
			2028E/M10S01											
			2028E/3S02											
			2028E/M10S02											
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			2028E/3S06											
			2028E/M10S06											
			2028E/4S07											
			2028E/M12S07											

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