

Smartive Relay Expander

CE technical file

SM-RELAY-EXP-CE-TF-EN-001 | Issue 1.0 | 2026-06-18 | Final

1. Product Identification

This technical file applies to the Smartive Relay Expander SM-RELAY-EXP Rev. 1.3 final mechanical-relay release configuration.

Field	Value
Product	Smartive Relay Expander
Model / code / revision	Relay Module / SM-RELAY-EXP / 1.3
Manufacturer	Apptive Kft, 9932 Viszák, Fő út 56, Hungary
Intended use	16-channel relay-output expander for Smartive systems, installed on DIN rail or inside a closed electrical/control cabinet.
PCB size	87.00 x 87.00 mm, from final Gerber outline
BOM / PnP	13 BOM lines, 123 components; 123 pick-and-place positions.
PCB construction	PCB specified for lead-free manufacture; Gerber, drill and CPL sources attached.

2. Electrical Configuration

Item	Final data
Supply	5 VDC SELV normal supply, with U1 DB125-3.81-2P auxiliary 5 V/GND power-injection input for the same SELV supply domain.
Auxiliary power injection	The U1 input may be used when simultaneous operation of many relays requires supplemental feed due to voltage drop or current margin. It shall be used only from a CE-marked 5 V SELV supply or the same supply circuit with matching polarity and common GND; a different-voltage or non-isolated supply shall not be connected.
Relays	16 x HRS3FNH-S-DC5V-A mechanical relay; 5 VDC coil; 125 ohm coil; Form A contact
Contact rating	For the specific 10A variant, the relay datasheet states 10 A 250 VAC. Product installation limit: max. 10 A @ 230 VAC external MCB/fuse per relay branch.
Relay protection	The relay does not include product-level surge protection/SPD. The datasheet provides insulation and dielectric-strength data; installation surge protection shall be provided externally where required.
Coil flyback	SM4007PL diode is included in the BOM for each relay coil.
Control	MCP23017-E/SS 16-bit I2C I/O expander + S8050 relay drivers
RJ45 extender pinout	SDA (I2C), 3.3V, 1-Wire, 5V, 5V, SCL (I2C), GND, GND

Relay Datasheet Boundary Data

Parameter	Value
Contact form	A-1 Form A
Contact material	Ag alloy
Contact resistance	100 mOhm max.
Insulation resistance	1000 Mohm min. (DC 500 V)
Dielectric strength	Between open contacts 1000 VAC / 1 min; between coil and contact 4000 VAC / 1 min.
Operating environment	-40 C to +85 C, no condensation

3. PCB Insulation and Current-Carrying Controls

Control	Final release data
HV-LV clearance/creepage	min. 5.5 mm
HV-HV 230 VAC clearance	min. 2.0 mm
HV-HV 230 VAC creepage	min. 4.0 mm
HV trace	With 1 oz/ft2 copper: 2.6 mm width per side, 5.2 mm effective width with two-sided parallel routing.
Temperature-rise calculation	The manufacturer release note records an expected approx. 17 C rise at 10 A, within the design margin.

4. Legislation and Standards Mapping

Area	Legislation	Standard / method	Release application
Safety	2014/35/EU LVD	EN 61010-1:2010 + A1:2019; EN IEC 61010-2-201:2018; EN 60664-1:2007	Relay control equipment, 230 VAC contact circuits, insulation, fire and thermal safety.
EMC	2014/30/EU EMC	EN 61000-6-1/-6-2/-6-3/-6-4; EN 61000-4-x test methods	Emission and immunity assessment of the wired relay expander module.
RoHS	2011/65/EU + (EU) 2015/863	EN IEC 63000:2018	Component, PCB and manufacturer material documentation.

5. BOM and Component Functions

ID	Component	Qty	Function
1	HRS3FNH-S-DC5V-A K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K1	16	5 V DC coil mechanical relay with 10 A 250 VAC contact rating
2	DB12S-3.81-2P-GN-S U1	1	Auxiliary 5 V/GND power-injection input for high relay load
3	DB128V-5.08-2P-GN-S CN1,CN2,CN3,CN4,CN5,CN6,CN7,CN8,CN9,CN10,CN11,CN12,CN13, CN14,CN15,CN16	16	230 VAC relay-output terminal block
4	SM4007PL D_B0,D_B1,D_B2,D_B3,D_B4,D_B5,D_B6,D_B7,D_A0,D_A1,D_A2,D_A3, D_A4,D_A5,D_A6,D_A7	16	Relay-coil flyback diode
5	KT-0603R LED_A0,LED_A1,LED_A2,LED_A3,LED_A4,LED_A5,LED_A6,LED_A7,LED_ B0,LED_B1,LED_B2,LED_B3,LED_B4,LED_B5,LED_B6,LED_B7,LED16	17	Status LED
6	S8050 Q_A0,Q_A1,Q_A2,Q_A3,Q_A4,Q_A5,Q_A6,Q_A7,Q_B0,Q_B1,Q_B2,Q_B 3,Q_B4,Q_B5,Q_B6,Q_B7	16	Relay-driver NPN transistor
7	0402WGF3300TCE R_A0,R_A1,R_A2,R_A3,R_A4,R_A5,R_A6,R_A7,R_B0,R_B1,R_B2,R_B3,R_B 4,R_B5,R_B6,R_B7,R16	17	Series, pull-up or driver resistor
8	0603WAF1501T5E U_A0,U_A1,U_A2,U_A3,U_A4,U_A5,U_A6,U_A7,U_B0,U_B1,U_B2,U_B3, U_B4,U_B5,U_B6,U_B7	16	Series, pull-up or driver resistor
9	0603WAF4701T5E R17,R18,R19	3	Series, pull-up or driver resistor
10	MCP23017-E/SS U16	1	16-bit I2C GPIO expander for relay-bank control
11	HB-PH8-25423PB2GOP U17	1	Internal/auxiliary pin header
12	CL10A106KP8NNNC C2	1	Supply decoupling capacitor
13	R-RJ45R08P-A004 RJ9,RJ10	2	RJ45 Smartive extender port

6. Risk Analysis and Controls

Risk / fault state	Consequence	Control	Verification
230 VAC relay branch overloaded above 10 A	Overheating of relay, terminal or PCB trace	External max. 10 A @ 230 VAC MCB/fuse mandatory per relay branch; the product does not replace a protective device.	Label, installation guide, thermal review
External surge on relay contact	Contact arcing, insulation stress, electronic disturbance	The relay provides insulation/dielectric withstand ratings only; no product-level SPD. External installation SPD where required.	Datasheet review, installation condition
HV-LV insulation fault	Electric shock or SELV side becoming hazardous	Min. 5.5 mm HV-LV clearance/creepage; relay coil-contact dielectric strength; closed enclosure/cabinet.	Gerber review, safety construction review
Relay contact welding or sticking	Load may remain energised	Relay is a functional switching element; critical loads require external isolation and protection concept.	FMEA, production switching test
Unsuitable 5 V SELV supply	Unstable operation, EMC or thermal issue	Only CE-marked SELV supply may be used, with adequate current margin.	Power draw and functional test
Incorrect polarity or different supply domain on 5 V/GND injection input	Supply-line overcurrent, heating or electronics damage	Polarity marking; common GND and same 5 V SELV supply domain; CE-marked SELV supply; final test.	Visual, polarity and voltage check
Incorrect RJ45 extender wiring	Communication failure or electronics damage	Pinout documented; Smartive-compatible SELV extender cable/module only.	Extender communication final test
RoHS unverified component	Material-conformity non-compliance	EN IEC 63000 BOM evidence, supplier datasheets and JLCPCB RoHS certificate.	Source-documentation review

7. Verification and Production Final Test Plan

Test	Method	Acceptance
Visual inspection	Check PCB, soldering, relays, terminals, RJ45 ports and markings.	No damage, missing part, soldering defect or marking error.
Relay functional test	Switch all 16 relays through MCP23017; measure contact continuity.	Each relay pulls in/releases reliably; no stuck contact.
U1 5 V/GND power-injection input	Check polarity, common-GND continuity and 5 V SELV voltage at U1.	Correct polarity, common GND, no abnormal current draw or heating.
230 VAC branch protection review	Review installation documentation and label.	Mandatory max. 10 A @ 230 VAC external OCPD text is present.
Extender port	SDA, SCL, 1-Wire, 3.3 V, 5 V, GND pinout and communication check.	Stable I2C/1-Wire communication with Smartive test fixture.
Insulation / dielectric review	Compare Gerber distances and relay datasheet insulation data.	HV-LV min. 5.5 mm; HV-HV clearance min. 2 mm; creepage min. 4 mm.
RoHS document review	Check BOM, supplier datasheets and PCB RoHS certificate.	The material-conformity claim is supported by the documented sources.

8. Sources Used

This document is based on the final release sources and the referenced official/supplier sources. Product identification, relay ratings, PCB spacing and current-carrying controls, installation limits and the RoHS documentation model are included in this technical file as standalone content.

Referenced EU Sources

Source	URL
Relay datasheet	https://www.zhejianghke.com/wp-content/uploads/2021/09/HRS3FN.pdf
JLCPCB RoHS certificate	https://rs.jlpcb.com/static/file/rohs-certificate-of-conformity.pdf
Technical documentation requirements	https://europa.eu/youreurope/business/product-requirements/compliance/preparing-technical-documentation/index_en.htm
CE marking requirements	https://europa.eu/youreurope/business/product-requirements/labels-markings/ce-marking/index_en.htm
LVD scope	https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/low-voltage-directive-lvd_en
LVD harmonised standards list	https://ec.europa.eu/docsroom/documents/62995/attachments/1/translations/en/renditions/native
EMC harmonised standards list	https://ec.europa.eu/docsroom/documents/51315/attachments/1/translations/en/renditions/native
RoHS harmonised standards list	https://ec.europa.eu/docsroom/documents/41283/attachments/1/translations/en/renditions/native

Viszák, Hungary, 2026-06-18

company signature / stamp

Szántó Gábor László

managing director