

lamaPLC project: Digitales Potentiometer Board Moduls

A digital potentiometer (or “digipot”), such as the **Renesas X9C** series, is a semiconductor device that replicates the function of a mechanical potentiometer—varying resistance—but replaces the manual knob with digital control signals.

Renesas X9C series

The X9C102, X9C103, X9C104, and X9C503 are digitally controlled (XDCCP) potentiometers. The device consists of a resistor array, wiper switches, a control section, and nonvolatile memory. The wiper position is controlled by a three-wire interface.



The potentiometer is implemented using a resistor array composed of 99 resistive elements and a wiper-switching network. Between each element and at either end are tap points accessible to the wiper terminal. The position of the wiper element is controlled by the CS, U/D, and INC inputs. The wiper position can be stored in non-volatile memory and recalled upon subsequent power-up.

The device can be used as a three-terminal potentiometer or a two-terminal variable resistor in a wide variety of applications, from control to signal processing to parameter adjustment.

Model	Total Resistance (R _{total})	Step Size (approx.)	Temp.Coefficient	Max Terminal Voltage Differential (ΔV)
X9C102	1K Ω	10.1 Ω	+600 ppm/ $^{\circ}$ C	4V

Full datasheet: <https://www.renesas.com/en/document/dst/x9c102-x9c103-x9c104-x9c503-datasheet>

Wiring

Communication topics on lamaPLC

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• ISM Band	2025/11/10 18:53	ism , ism band , rfid , nfc , dash7 , hc-12 , arduino , zigbee , z-wave , bluetooth , wi-fi , thread , miwi , nrf24 , starlink , wiegand , rf , communication , bus , radio , ku band , ka band , k band , x band
• lamaPLC Communication: 1-Wire	2025/05/31 21:56	1-wire , communication , bus , microlan , i2c , uart , usart , ds18b20
• lamaPLC Communication: AS-i	2025/05/31 22:51	bus , communication , as-i , basic , industrial ethernet , devicenet , interbus , manchester-ii , apm
• lamaPLC Communication: Bluetooth basic	2025/11/19 21:52	communication , bus , bluetooth , ism , ieee , 802.15.1 , ble , lmp , l2cap , rfcomm , iot , arduino , hc-05 , hc-06
• lamaPLC Communication: CAN	2025/11/20 20:43	communication , bus , can , canopen , most , automotive ethernet , sent sae-j2716 , flexray , lin bus
• lamaPLC Communication: ControlNet	2025/05/31 22:58	bus , communication , devicenet , cip , can , ethernet ip , ethernet , controlnet , mac , peer-to-peer , allen-bradley , rockwell automation , fieldbus , rg-6 , coaxial cable
• lamaPLC Communication: DALI	2024/11/16 20:08	communication , rs-232 , dali , light technic , diia , selv , manchester , asynchronous , half-duplex , serial , iec 62386 , d4i , dali-2 , dt6 , dt8
• lamaPLC Communication: DASH7	2024/11/16 20:21	bus , communication , dash7 , ism , srd , aes 128 , d7a , blast , iot , rfid
• lamaPLC Communication: DeviceNet	2024/11/16 19:43	bus , communication , devicenet , 62026-3 , cip , can , ethernet ip , ethernet , controlnet , mac , peer-to-peer , canopen , allen-bradley , rockwell automation , bosch
• lamaPLC Communication: DMX512	2024/11/16 00:16	bus , communication , dmx512 , dmx512-a , rs-485 , xlr3 , xlr5
• lamaPLC Communication: EtherNet/IP	2024/11/17 00:26	communication , ethernet , bus , ip , cip , ethernet ip , udp , industrial ethernet , ie , tcp , unicast , devicenet , controlnet , ieee 802.3
• lamaPLC Communication: GPS	2024/11/15 20:15	communication , satellite , navigation , gps , ocx , cdma , glonass , beidou , galileo , qzss , uart , arduino
• lamaPLC Communication: IEC 61850 basic	2025/09/23 21:03	1-wire , communication , bus , xml , iec 61850 , iec , ethernet , scl , goose , ied
• lamaPLC Communication: InterBus	2024/11/16 00:46	bus , communication , interbus , phoenix contact , en 50254 , iec 61158
• lamaPLC Communication: IoT	2025/05/31 22:50	communication , iot , internet , iomt , 6lowpan , ipv4 , ipv6 , bluetooth , ble , li-fi , nfc , rfid , wi-fi , zigbee , z-wave , lte-advanced , 5g , lora , dash7 , lpwan , lorawan , sigfox , nb-iot , weightless , rpma , mioty , vsat , ethernet , thread , matter
• lamaPLC Communication: I²C	2025/09/23 19:25	i2c , i c , smbus , philips , bus , communication , arduino

• lamaPLC Communication: KNX / EIB	2024/11/15 20:18	communication, bus, knx, knx tp, knx pl, knx rf, knx ip, eib, ehs, batibus, ethernet, ets
• lamaPLC Communication: LoRa, LoRaWAN and LoRa Mesh	2026/03/05 15:43	communication, bus, lora, lorawan, loramesh, mesh, ism, the things network, ttn, aloha, beaconing, csma, csma-ca, mac, adaptive data rate, adr, spreading factor, sf, transmission power, eu863, eu863-870, eu433, us902-928, au915-928, as923, in865-867, cn433, cn470, cn779, cn920, semtech, sx1261, sx1262, sx1276, sx1272, sx1278, encoding rate, er, time on air, toa, iot, netid, listen before talk, lbt
• lamaPLC communication: Matter	2024/11/15 20:21	communication, iot, matter, ethernet, tcp, udp, ipv6, thread, ble, cellular, wifi, pki, ip
• lamaPLC Communication: Modbus	2025/11/19 21:42	modbus, communication, bus, modicon, standard, rtu, tcp, multimaster, coil, register
• lamaPLC Communication: MQTT	2024/11/15 20:28	communication, mqtt, iot, tcp, udp, bluetooth, tcp ip, quic, mqtt-sn, oasis, message broker, mosquitto, qos, arduino, iso iec 20922
• lamaPLC Communication: NFC	2025/05/31 22:16	communication, nfc, rfid, bluetooth, ble, manchester, ask, iso iec 18092
• lamaPLC Communication: NRF24	2024/11/16 01:26	bus, communication, nrf24, ism, ism band, gfsk, rpd, arduino
• lamaPLC Communication: OPC	2024/11/15 20:33	communication, opc, scada, ole, net, xml, tcp, hmi, server, opc ua, opc ua client, mqtt, json, dcom, simatic, erp
• lamaPLC Communication: PowerLink	2024/11/15 21:15	communication, bus, ethernet, tcp, udp, http, powerlink, fast ethernet, opensafety
• lamaPLC Communication: Profibus	2024/11/16 19:09	profibus, profibus pa, profibus dp, communication, fieldbus, bus, iec 61158, iec 61784-1, profinet, rs-485
• lamaPLC Communication: RFID	2025/05/31 21:52	communication, rfid, radio, rf, aidc, prat, arpt, arat, bap, uhf, nfc, em4100, t5557, tag, manchester, fsk, psk, biphasse, nrz
• lamaPLC Communication: RS-232	2024/11/15 21:51	bus, communication, rs-232, rs, basic
• lamaPLC Communication: RS-422	2024/11/15 21:50	bus, communication, rs-422, rs, basic
• lamaPLC Communication: RS-485	2024/11/15 21:52	bus, communication, rs-485, rs, basic, profibus
• lamaPLC Communication: SCADA	2024/11/17 00:33	communication, scada, industry, industrial, hmi
• lamaPLC Communication: Sinec H1	2024/11/16 20:44	communication, bus, fieldbus, sinec-h1, s5, s7, simatic, siemens, industrial ethernet, ie, iec 8073
• lamaPLC Communication: SPI	2024/11/15 21:58	bus, communication, spi, basic, arduino, ssi, sdi, miso, sdo

• lamaPLC Communication: TCP / UDP Basic	2025/11/20 21:49	communication, bus, tcp, udp, tcp ip, darpa, ietf, smtp, http, https, ftp, ftps, ssh, pop3, imap, mysql, cpanel, whm, ssl, webmail, mqtt, ethernet, ip
• lamaPLC communication: Thread	2024/11/15 22:07	bus, communication, matter, thread, matter over thread, zigbee, aes, ipv6, iot, 6lowpan, ethernet, wifi
• lamaPLC Communication: UART / USART basic	2025/02/11 20:21	bus, communication, uart, rs-232, rs-422, rs-485
• lamaPLC Communication: USB	2025/11/20 23:07	usb, usb otg, otg, msc, ums, mtp, dfu, uac, adc, communication, bus, basic
• lamaPLC Communication: Wi-Fi	2024/11/16 18:46	communication, iot, internet, wi-fi, wifi, ieee 802.11
• lamaPLC Communication: Wiegand	2024/11/16 23:39	wiegand, communication, interface, cr80, iec 7810, h10301, hid, wiegand 26, wiegand 32, wiegand 34, wiegand 35, wiegand 37, wiegand 38, wiegand 42
• lamaPLC Communication: WS2812	2024/11/15 23:36	bus, communication, ws2812, ws2812b, ws 2812, ws 2812 b, 5050smd, 4020, 2020, 3535, 5050, nzs, rgb chip, led, arduino, rgb
• lamaPLC Communication: Z-Wave	2024/11/17 21:25	communication, ethernet, bus, ip, z-wave, ism
• lamaPLC Communication: Zigbee	2024/11/17 21:43	communication, ethernet, bus, ip, zigbee, wpan, bluetooth, wi-fi, ism, ieee 802.15.4, zdo, zigbee pro, zc, zr, zed, smart energy, homegrid, homeplug, powerline, ipso, sunspec, 6lowpan, ipv6, rf4ce
• LamaPLC: AHT10 Modul	2026/03/21 19:20	communication, i2c, temperature, humidity, sensor, aht, aht 10, modul
• lamaPLC: AI-Thinker LoRA products	2026/03/05 15:40	ai-thinker, lora manufacturer, communication, lora, modul, ra-01, ra-02, spi, arduino
• LamaPLC: APDS - Avago ALS and proximity detection sensors with I²C communication	2026/02/14 22:24	avago, apds-9900, apds-9930, apds-9960, als, proximity, detection, gesture recognition, gesture, i2c, communication, sensor, arduino, code
• lamaPLC: AS5600 Magnetic Induction Angle Measurement Sensor Module	2026/03/28 22:07	communication, i2c, as5600, as-5600, magnetic, induction, angle, sensor
• LamaPLC: BMP/BME Bosch Temperature/Humidity/Pressure sensors with I²C communication	2026/02/15 20:40	bme280, bme680, bmp180, bmp280, hw-611, hw611, bosch, temperature, humidity, pressure, sensor, arduino, i2c, communication, cjmcu
• lamaPLC: CJMCU-164; SN74HC164D 8-bit Shift Register Module	2026/02/14 22:48	cjmcu-164, sn74hc164d, 8-bit shift register, communication, 7-segment, cjmcu, arduino
• LamaPLC: CJMCU-219/INA-219 breakout board/IC with I²C communication	2026/02/14 23:37	cjmcu-219, ina-219, ina219, breakout board, i2c, communication, sensor, voltage, current, arduino, code, cjmcu

<ul style="list-style-type: none"> • LamaPLC: CJMCU-3216 / AP-3216 integrated digital ambient light and proximity sensor module/IC with I²C communication 	2026/02/14 22:40	cjmcu-3216, cjmcu, ap-3216, ap3216, ambient light, proximity, sensor, arduino, code, i2c, communication
<ul style="list-style-type: none"> • LamaPLC: CJMCU-3901/PMW-3901 compact optical flow sensor module/IC by PixArt with SPI communication 	2026/02/14 22:39	cjmcu-3901, cjmcu, pmw3901, pmw-3901, optical flow, sensor, pixart, spi, communication, arduino, code, pmw3901mb-txqt
<ul style="list-style-type: none"> • LamaPLC: CJMCU-6701: Biosensor for measuring Galvanic Skin Response (GSR) with SPI communication 	2026/02/14 23:39	cjmcu, cjmcu-6701, acs758, acs-758, galvanic skin response, gsr, electrodermal activity, eda, spi, communication, arduino, code, sensor, healthcare
<ul style="list-style-type: none"> • LamaPLC: DPS Infineon Temperature/Pressure sensors with I2C communication 	2026/02/14 18:11	dps310, infineon, temperature, pressure, sensor, arduino, i2c, communication, code
<ul style="list-style-type: none"> • lamaPLC: DS18B20 1-Wire Digital Thermometer 	2026/02/15 20:44	ds18b20, sensor, 1-wire, communication, arduino, thermometer, parasitic mode
<ul style="list-style-type: none"> • lamaPLC: Ebyte LoRA products 	2026/03/05 15:20	ebyte, lora manufacturer, communication, lora, modul
<ul style="list-style-type: none"> • lamaPLC: Energy, power, current, and voltage 	2025/05/31 21:32	i2c, i c, communication, arduino, energy, power, current, sensor, ina226
<ul style="list-style-type: none"> • LamaPLC: ENS ScioSense Multi-gas sensors with I²C communication 	2026/02/14 19:29	ens160, sciosense, gas-quality, i2c, communication, sensor, arduino, code, eco2, tvoc, aqi, indoor air quality, iaq, co2, voc
<ul style="list-style-type: none"> • lamaPLC: ESP32 / ESP8266 	2025/11/21 23:07	esp8266, esp32, esp32-c2, esp32-c3, esp32-c5, esp32-c6, esp32-c61, esp32-h2, esp32-s2, esp32-s3, esp32-p4, espressif systems, communication, ethernet, ip, wi-fi, thread, zigbee, matter, homekit, bluetooth, mqtt, adc, spi, uart, i2c, i2s, rmt, pwm, usb, usb otg, twai
<ul style="list-style-type: none"> • LamaPLC: Gas sensors 	2023/07/01 15:29	gas, sensor, i2c, onewire, communication, mq-3, mq-4, mq-5, mq-6, mq-7, mq-8, mq-9, mq-135, gm-102b, gm-302b, gm-502b, gm-702b, alcohol, ch4, natural gas, smoke, lng, co, co2, lpg, h2, iso-butane, nox, nh3, benzene, town gas, formaldehyde, propane, humidity, temperature, voc, grv gas sens v2
<ul style="list-style-type: none"> • LamaPLC: GY-9250 MPU-9250/6500 9-axis Attitude Sensor Board 	2026/02/14 22:45	ak8963, gy-9250, mpu-9250, 9-axis, motion detection, magnetometer, communication, i c, i2c, spi
<ul style="list-style-type: none"> • LamaPLC: HDC Texas Instruments Temperature/humidity sensors with I²C communication 	2026/02/14 22:09	sht21, htu21, si7021, gy-21, gy-213v, hdc1080, gy-213v-hdc1080, cjmcu, cjmcu-1080, texas instruments, temperature, humidity, sensor, i2c, communication, arduino, code

• LamaPLC: HTU TE Connectivity temperature/humidity sensors with I²C communication	2026/02/14 21:54	htu , htu31d , htu21d , htu20d , sht20 , htu20 , sht21 , htu21 , si7021 , gy-21 , gy-213v , hdc1080 , si702 , gy-20 , sht31 , htu31 , si7031 , gy-31 , te connectivity , temperature , humidity , i2c , communication , sensor , arduino , code
• LamaPLC: HX711 24-bit analog-to-digital converter (ADC)	2026/02/15 23:59	hx711 , hx-711 , analog-to-digital , adc , converter , load cell , wheatstone bridge , weight , sensor , communication , arduino , code
• lamaPLC: INA modules with Arduino libraries	2026/03/28 18:02	i2c , i c , communication , arduino , energy , power , current , monitor , sensor , ina219 , gy-219 , ina226 , gy-216 , ina228 , gy-228 , ina237 , ina238 , ina260 , ina3221 , ina
• lamaPLC: INA226 - current/voltage/power monitor with I²C communication	2026/02/14 23:58	i2c , i c , communication , arduino , energy , power , current , monitor , sensor , ina226 , ina219 , ina
• lamaPlc: Industrial Ethernet (IE) Basic	2024/11/15 20:17	communication , bus , ethernet , industrial ethernet , ie , ethercat , ethernet ip , profinet , powerlink , sercos , iii , cc-link , modbus tcp , ieee , rstp , stp
• lamaPLC: LCD 1602/2004 with I²C communication	2026/02/14 17:27	communication , i2c , display , lcd , 1602 , 2004 , hd44780 , pcf8574 , pcf8574t , pcf8574at , arduino
• lamaPLC: LTC3588 - Nanopower energy harvesting power supply IC	2026/02/14 23:35	communication , arduino , sensor , energy harvesting , energy , ambient power
• LamaPLC: MAX30100/MAX30102 Heart Rate Click Sensor Module	2026/02/14 23:38	max30102 , max30100 , heart rate click , sensor , communication , i2c , arduino , code
• lamaPLC: MCP23017 / MCP23S17 16-Bit I/O Expander with Serial Interface I²C / SPI	2026/02/14 22:52	communication , i2c , mcp23017 , mcp23s17 , spi , i o expander , serial , cjmcu-2317 , cjmcu
• LamaPLC: MH-Z19 series of NDIR CO₂ sensors	2026/02/15 20:20	mh-z19 , mh-z19d , mh-z19c , mh-z19b , mh-z19e , ndir , co₂ , sensor , winsen , uart , pwm , communication , non-dispersive infrared , infrared , ir , temperature , arduino , code , tasmota
• LamaPLC: Pixart PAJ7620U2 Gesture recognition sensors/module with I²C communication	2026/02/14 22:23	paj7620u2 , gy-paj7620 , pixart , gesture recognition , i2c , communication , sensor , arduino , code
• lamaPlc: Profinet	2024/11/15 20:39	communication , bus , profinet , mrp , rstp , gsdml , xml , profibus , ethernet , tcp
• lamaPLC: PTA8C04 4-channel PT100 Modbus Modul	2026/02/14 17:42	pta8c04 , sensor , modbus , rtu , rs-485 , communication , platine , um72
• LamaPLC: S7-1500 and Metrawatt EM2389 Modbus TCP communication	2024/11/18 17:55	simatic , s7 , modbus , communication , metrawatt , em2389 , source code , scl , mid
• LamaPLC: S7-1500 and Sicam Q200 Modbus TCP communication	2023/06/24 22:42	simatic , s7 , modbus , tia portal , communication , sicam , q200 , sicam q200 , source code , scl , class a

• lamaPLC: S7-1500 and UICPAL Temp.humi.sensor Modbus TCP communication	2023/06/19 21:24	bus, communication, s7, simatic, s7 1500, s7 1200, scl, uicpal, temperature, humidity, modbus, example, download, tia portal
• LamaPLC: SGP Sensirion Gas-sensors with I ² C communication	2026/02/15 20:27	sgp30, sgp40, sgp41, sensirion, gas-sensor, i2c, communication, sensor, arduino, code, eco ₂ , voc, tvoc, indoor air quality, iaq, nox, hydrogen
• LamaPLC: SHT Sensirion Temperature/humidity sensor with I ² C communication	2026/02/15 20:29	sht20, sht21, sht25, sht30, sht31, sht35, sht40, gy21, temperature, humidity, i2c, communication, sensor, arduino, code
• lamaPLC: TCA9548A (HW617); Low-Voltage 8-Channel I ² C Switch Module	2026/02/14 22:51	tca9548a, hw617, i2c, switch, communication, expansion board, arduino
• LamaPLC: Texas Instruments ADCs: Delta-sigma multi-channel Analog Converters with SPI communication	2026/02/15 22:34	ads111x, ads12xx, delta-sigma, converter, texas instruments, adc, spi, communication, sensor, arduino, code, ads1110, ads1112, ads1113, ads1114, ads1115, ads1118, ads1119, ads1220, ads1232, ads1234, ads1256, ads1261, ads1263, multi channel
• LamaPLC: TOFnnnC STMicroelectronics Time-of-Flight (ToF) sensors with I ² C communication	2026/02/14 22:22	tof050c, vl6180, tof200c, vl53l0x, tof400c, vl53l1x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code
• lamaPLC: TWAI basics	2025/11/20 21:41	bus, communication, as-i, basic, can, twai, espressif, esp32
• LamaPLC: UICPAL Temp.humi.sensor	2023/06/24 22:43	simatic, s7, modbus, communication, temperature, humidity, sensor
• LamaPLC: VL53Lnn STMicroelectronics time-of-flight (ToF) laser-ranging sensors with I ² C communication	2026/02/14 22:21	vl53l0x, vl53l1x, vl53l0 1xv2, gy-530, time-of-flight, tof, laser-ranging, i2c, communication, sensor, arduino, code
• LamaPLC: VL6180X STMicroelectronics Time-of-Flight (ToF) sensor with I ² C communication	2026/02/14 22:22	vl6180x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code
• lamaPLC: Waveshare LoRA products	2026/03/05 15:20	waveshare, lora manufacturer, communication, lora, modul, usb-to-lora-xf02, core 1262, 1262, spi, arduino, rp2040-lora, rp2040
• LamaPLC: XTM35SC Modbus communication	2024/08/18 14:52	xtm35sc, modbus, modbus rtu, measuring, power, communication, current meter, voltmeter
• lamaPLC: YR-3180 - Weight sensor module with UART or Modbus communication	2026/02/14 23:00	communication, modbus, rtu, sensor, weight, yr-3180, hx710b, arduino, ttl, rs-485
• Magnetic angle sensors	2026/03/05 20:19	magnetic angle sensor, magnetic flux, sensor, spi, i2c, pwm, communication, modul, as5047p, as5600, mt6701, mt6816, mt6835, tle5012b, amr, gmr, tmr, anisotropic magnetoresistive
• NT18B07: 7 Kanal RS485 Temperatur Sensor with Modbus RTU	2026/02/14 17:49	nt18b07, sensor, modbus, rtu, rs-485, communication, platine

- [Simatic Modbus S7 error- and statuscodes](#) 2025/11/13 22:59 [communication, bus, modbus, error, modbus error code, 7000, 7001, 7002, 7003, 7004, 7005, 7006, 80a1, simatic, s7, siemens, tia](#)
 - [Waveshare](#) 2023/06/17 19:43 [waveshare, converter, modbus, modbus rtu, modbus tcp, communication](#)
 - [XTM35SC current / voltage meter](#) 2023/06/01 11:45 [xtm35sc, modbus, modbus rtu, measuring, power, communication, current meter, voltmeter](#)
- [BMP280, AHT20, temperature, humidity, pressure, sensor, arduino, oled, SH1106, arduino code](#)

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