control solutions
TERACOM



TDO340

MODBUS RTU relay output module

USER MANUAL

1. Short description

The MODBUS RTU relay output module, model TDO340, is a 4-channel SPST relay device with independent contacts, designed for industrial control applications. The module fully supports the MODBUS RTU protocol and allows flexible configuration of relay behavior both at power-up and in the event of Modbus communication loss.

The TDO340 features a configurable watchdog mechanism that monitors Modbus RTU communication and applies predefined relay actions when communication is interrupted, helping to ensure predictable and controlled system behavior. Relay states and configuration parameters are stored in nonvolatile memory, allowing the device to retain and restore the last valid settings after a power cycle.

The device can be used as a relay output extension for Modbus RTU master devices such as PLCs, industrial controllers, and embedded systems..

2. Features

- RS-485 interface supporting up to 63 nodes
- Non-volatile memory for the relays' status
- LED indicator for communication status
- Watchdog functionality for communication loss
- Reinforced isolation of relay contacts
- Built-in 120 ohms termination resistor
- DIN rail mounting
- Firmware update via the interface

3. Applications

- AC/DC consumers commutation
- Industrial process control

4. Specifications

- Physical characteristics
  Dimensions: 52x91x59mm (3-module enclosure)
  Weight: 101g
  Mounting: On 35 mm DIN top-hat rail
- Environmental limits
  Operating temperature range: -20 to 60°C
  Operating relative humidity range: 10 to 90% (non-condensing)
  Storage temperature range: -25 to 65°C
  Storage relative humidity range: 5 to 95% (non-condensing)
  Ingress protection: IP40 (connections IP20)
- Power supply
  Operating voltage range (including -15/+20% according to IEC 62368-1): 5 to 28VDC
  Current consumption: 130mA@5V
- Relay outputs
  Maximum switching current: 3A
  Maximum switching AC voltage: 250V
  Maximum switching DC voltage: 30V
  Rated load: 3A at 250VAC, resistive, 50k cycles
  3A at 30VDC, resistive, 30k cycles
  Isolation: 4000 Vrms coil to contact
  1000 Vrms between open contacts
  CAUTION:
  The device does not contain any internal overcurrent protection facilities on the relay's contact lines. External fuses or short circuit current limiting circuit breakers, rated to 3 Amps, are to be used for overcurrent protection of the connecting lines.
  If the device is used to switch dangerous voltages (over 30V), a skilled person must install the device in rooms with controlled access.
- Interface
  Protocol: Modbus RTU
  Physical layer: RS-485 serial line
  Number of bus transceivers: up to 63

Bus cable: Twisted, shielded, 2×0.5mm²
Response time ≤ 50ms
Master response time-out ≥ Response time + Answer time
The answer time depends on the number of bits and the baud rate.

- Connectors
  Communication: 3.81mm pitch screwless pluggable for 28 to 16 (AWG) / 0.081 to 1.31 (mm²) wires
  Relay outputs: 5.08mm pitch screwless pluggable for 26 to 14 (AWG) / 0.2 to 1.5 (mm²) wires

5. Indicators

The status of the device is shown by “Status” LED:

- If the LED blinks every 1 second, the sensor is working properly;
- If the LED blinks every 3 seconds, there is no communication with the controller;
- If the LED does not blink, there is no power supply.

Each relay has a dedicated LED to show its status. A lit LED means the relay is activated (contacts are closed)

6. Pinout

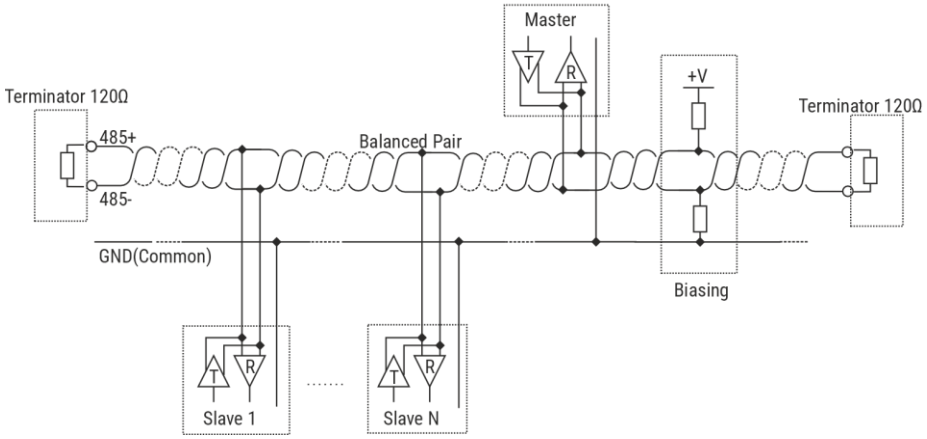
- 5-pins connector
  1 +VDD (5-28)
  2 GND
  3 RS485+
  4 RS485-
  5 Terminator
- 8-pins connector
  1-2 Relay 1 NO contacts
  3-4 Relay 2 NO contacts
  5-6 Relay 3 NO contacts
  7-8 Relay 4 NO contacts



Inside the device, a 120 Ω resistor is connected with one end to RS485+ and the other end to Term.
To enable 120 Ω bus termination, connect Term to RS485– externally with a wire.

7. Installation

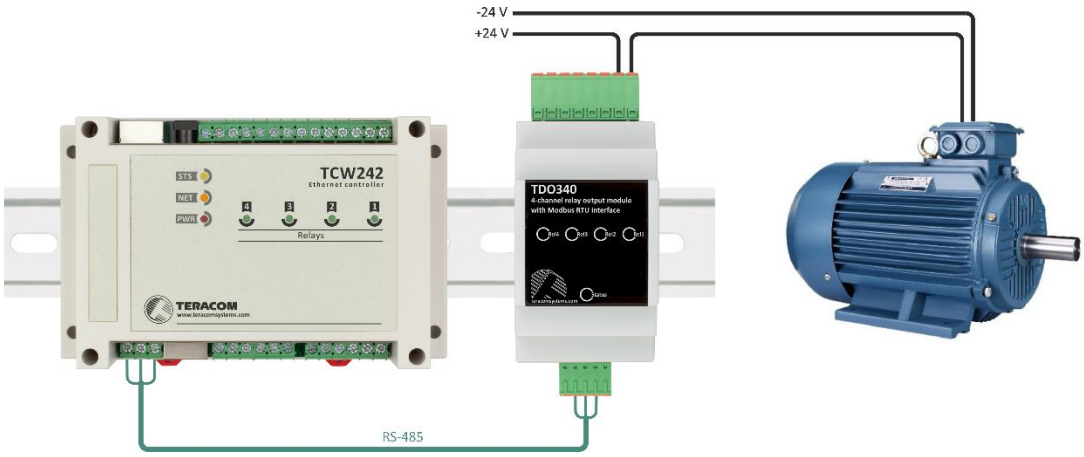
According to modbus.org, the "Two-Wire" MODBUS definition states:
“A MODBUS solution over a serial line should implement a “Two-Wire” electrical interface in accordance with the EIA/TIA-485 standard. On such a “Two-Wire” topology, only one driver can transmit at any time. Additionally, a third conductor must interconnect all the devices on the bus - the common.”



A daisy-chain (linear) topology and UTP/FTP cables are strongly recommended for multiple sensors.
For proper operation of the interface, terminators (120 ohms resistors) must be installed at both ends of the bus. The device has a built-in 120-ohm resistor. To terminate the bus, the “RS485-” and “Term” terminals must be shorted.

8. Typical application

A typical DC motor control application using the TDO340 is shown below:



9. No-communication (Watchdog) Relay Behavior

The device provides a configurable watchdog mechanism that defines the behavior of each relay in case Modbus RTU communication with the device is lost for a period longer than the configured timeout.

A no-communication condition is detected when no valid Modbus request addressed to the device is received within the time interval defined in register 305. Any valid Modbus read or write request resets the timeout counter.

If the timeout value (register 305) is set to 0, the no-communication watchdog function is disabled and no action is taken, regardless of the communication state.

When the timeout expires (register 305 > 0), the device applies the configured no-communication behavior independently for each relay, as defined in registers 301 to 304:

- The relay may remain in its last state,
- be forced to the activated or deactivated state, or
- be temporarily switched to the opposite state for a defined pulse duration (register 306).

When the pulse mode is selected, the relay changes to the opposite of its last state for the duration specified in register 306, after which it returns to its previous state. This mode can be used, for example, to generate a reset pulse for an external device.

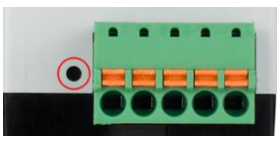
After Modbus communication is restored, relays remain in their current state until a new control command is received via Modbus.

Invalid register values are ignored and the last valid configuration is retained.

Caution: Incorrect configuration of the no-communication behavior may result in unintended relay activation. It is recommended to carefully verify all timeout and relay behavior settings before commissioning.

10. Factory default settings

Disconnect the power supply.
Press and hold the “RESET” button.
While holding the button, connect the power supply.
The status LED will turn ON for 3 seconds, then flash for 7 seconds, and finally turn ON again.
Release the button. The device will restart with factory default settings.



11. Firmware update

The firmware of the device can be updated by Teracom controller with MODBUS RTU supports or MBRTU-Update software.

To put the sensor in update mode, follow these steps:

- Disconnect the sensor from the bus and the power supply.
- Press and hold the “RESET” button. While holding the button, reconnect the power supply.
- The status LED will turn ON for 3 seconds. During these 3 seconds, release the button and press it 3 times to enter update mode.

In update mode, the status LED will remain ON permanently.

Important: The sensor can be updated only if it is the sole device on the bus.

12. Modbus address table

Register name	R/W	FC	Decimal address		Data size format	Default	Valid values
			PDU	Logical			
Holding registers							
RS-485 address	R/W	3, 6, 16	10	40011	uint16	1	1 to 247
Baud rate *	R/W	3, 6, 16	11	40012	uint16	19200	2400, 4800, 9600, 19200, 38400, 57600
Parity, data, stop bits *	R/W	3, 6, 16	12	40013	uint16	1	1=E81, 2=O81, 3=N81
Device code	R	3	14	40015	uint16		0x00DF
FW version	R	3	15	40016	uint16		
Vendor URL	R	3	18	40019	64 bytes UTF-8		teracomsystems.com
Float test value (MSW)	R	3	82	40083	32-bit float		-9.9(0xC11E6666)
Float test value (LSW)	R	3	84	40085	32-bit float		-9.9(0xC11E6666)
Signed integer test value	R	3	86	40087	16-bit sig. integer		-999(0xFC19)
Signed integer test value (MSW)	R	3	87	40088	32-bit sig. integer		-99999(0xFFFE7961)
Signed integer test value (LSW)	R	3	89	40090	32-bit sig. integer		-99999(0xFFFE7961)
Unsigned integer test value	R	3	91	40092	uint16		999(0x03E7)
All relay outputs, binary	R/W	3, 6	100	40101	uint16		0b0000000000000000 to 0b0000000000001111
Relay 1 output, binary	R/W	3, 6	101	40102	uint16		0b0000000000000000 to 0b0000000000000001
Relay 2 output, binary	R/W	3, 6	102	40103	uint16		0b0000000000000000 to 0b0000000000000001
Relay 3 output, binary	R/W	3, 6	103	40104	uint16		0b0000000000000000 to 0b0000000000000001
Relay 4 output, binary	R/W	3, 6	104	40105	uint16		0b0000000000000000 to 0b0000000000000001
Relays power-on state Note: Registers 201–204 are evaluated only if this register is set to value 3.	R/W	3, 6	200	40201	uint16	0	0 - Restore last successfully set states 1 - Activate all relays 2 - Deactivate all relays 3 - Use individual relay settings (registers 201–204)

Relay 1 power-on state	R/W	3, 6	201	40202	uint16	0	0 - Restore last successfully set state 1 - Activate relay 2 - Deactivate relay
Relay 2 power-on state	R/W	3, 6	202	40203	uint16	0	0 - Restore last successfully set state 1 - Activate relay 2 - Deactivate relay
Relay 3 power-on state	R/W	3, 6	203	40204	uint16	0	0 - Restore last successfully set state 1 - Activate relay 2 - Deactivate relay
Relay 4 power-on state	R/W	3, 6	204	40205	uint16	0	0 - Restore last successfully set state 1 - Activate relay 2 - Deactivate relay
Relay 1 no-communication behavior (timeout defined in register 305)	R/W	3, 6	301	40302	uint16	0	0 - relay remains in its last state 1 - relay will be activated 2 - relay will be deactivated 3 - relay is switched to the opposite of its last state for the duration defined in register 306, then returns to its previous state.
Relay 2 no-communication behavior (timeout defined in register 305)	R/W	3, 6	302	40303	uint16	0	0 - relay remains in its last state 1 - relay will be activated 2 - relay will be deactivated 3 - relay is switched to the opposite of its last state for the duration defined in register 306, then returns to its previous state.
Relay 3 no-communication behavior (timeout defined in register 305)	R/W	3, 6	303	40304	uint16	0	0 - relay remains in its last state 1 - relay will be activated 2 - relay will be deactivated 3 - relay is switched to the opposite of its last state for the duration defined in register 306, then returns to its previous state.
Relay 4 no-communication behavior (timeout defined in register 305)	R/W	3, 6	304	40305	uint16	0	0 - relay remains in its last state 1 - relay will be activated 2 - relay will be deactivated 3 - relay is switched to the opposite of its last state for the duration defined in register 306, then returns to its previous state.

Modbus no-communication timeout	R/W	3, 6	305	40306	uint16	0	0 - No-communication watchdog disabled 1 to 65535 - communication timeout in seconds
Watchdog pulse duration (Used only when registers 301–304 are set to value 3)	R/W	3, 6	306	40307	uint16	1	1 to 255 - pulse period in seconds
Discrete outputs							
Relay 1	R/W	1, 5	1	2	bit	0	0 or 1
Relay 2	R/W	1, 5	2	3	bit	0	0 or 1
Relay 3	R/W	1, 5	3	4	bit	0	0 or 1
Relay 4	R/W	1, 5	4	5	bit	0	0 or 1

* The settings will take effect after restarting the device by power-off, power-on.
PDU address: Actual address bytes used in a Modbus Protocol Data unit
The shown logic decimal addresses are calculated with offsets 40001 (holding registers) and 1 (discrete outputs).

13. Recycling

Please recycle all applicable materials in accordance with local regulations.



Do not dispose of the device as regular household waste.
Electronic components should be properly recycled to minimize environmental impact.

