Monitoring Technique

VARIMETER
DC voltage relay, for Modbus
UG 9431

DOLD

Product Description

The DC volage relay UG 9431 of the VARIMETER PRO series allows easy parameter setting, monitoring and diagnosis via a Modbus RTU interface. The measuring relay monitors DC networks for overvoltages and undervoltages as well as voltage range violations. Early detection of impending failtures and preventive maintenance prevent costly damage and as a user you benefit from the operational safety and high availability of your system.

Your Advantages
- Simple parameterization, monitoring and diagnosis
- Compact design
- Large measuring range DC 20 ... 1000 V
- Min-, Max-value or window monitoring
- Early detection of irregularities
- Increases plant availability and productivity
- Differentiated error messages
- Space and cost saving
- Reduced wiring
- Lower investment, operating and maintenance costs

Features
- Multifunctional measuring relay acc. to IEC/EN 60255-1
- With galvanic separated Modbus RTU interface
- For DC monitoring
- Start up time delay, response delay, delay on de-energisation
- Adjustable hysteresis 0.2 ... 50 % of the response value
- Error memory
- 2 changeover contacts
- Relay function energized / de- energized on trip parameterizable
- Width 22.5 mm

Function Diagram
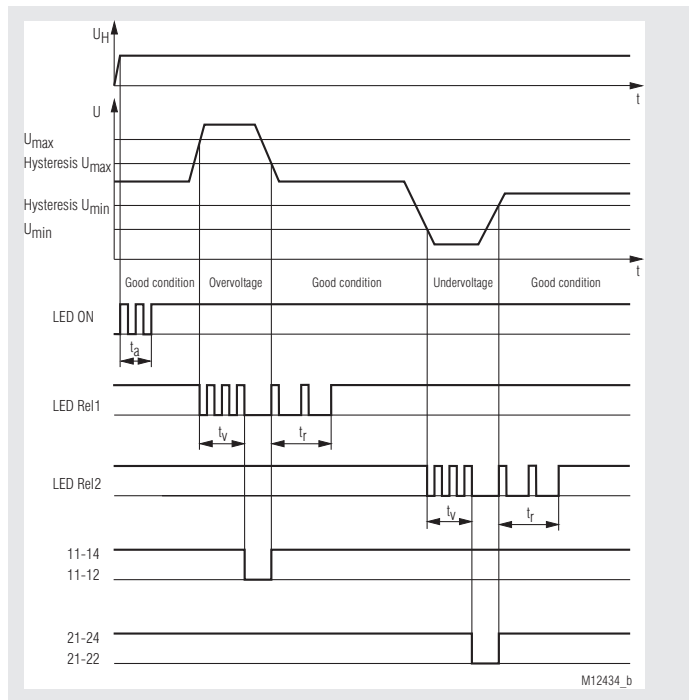
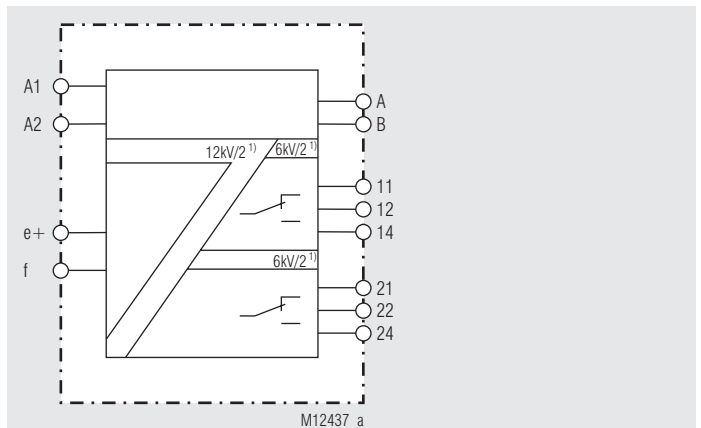Function: De-energized on trip, Overvoltage / Undervoltage

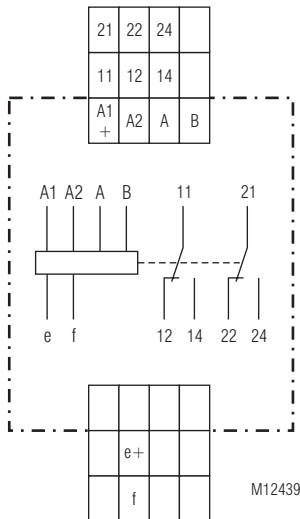### Approvals and Markings

$C\epsilon$

Applications

For monitoring direct current voltage supply systems to detect undervoltage, overvoltage

Block Diagram

[1] Rated impulse voltage / pollution degree

Alle Angaben in dieser Liste entsprechen dem technischen Stand zum Zeitpunkt der Ausgabe.
Technische Verbesserungen und Änderungen behalten wir uns jederzeit vor.

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Connection Terminals

Terminal designation	Signal description
A1 +, A2	Auxiliary voltage DC
e+, f	Voltage measuring input DC
11, 12, 14	Indicator relay (C/O contact)
21, 22, 24	Indicator relay (C/O contact)
A	Modbus signal A
B	Modbus signal B

Function

After connecting the auxiliary supply to terminals A1-A2 the startup time delay disables the monitoring function so that changes on the input have no influence on the relay output.

One or more measuring values can be assigned to the relay output. If the setting value of at least one function is exceeded the relay switches.

It is possible to assign different values to the different relays so one can be used as pre-warning and the other as alarm output. Relay output 1 switches when actual value exceeds the pre-warning setting of at least one assigned measuring function. If a second setting assigned to relay output 2 with the same measuring function the unit gives an Alarm signal.

Remarks

The amount of input voltage is analysed for the devices.

Indicators

The LED indicates the device status.

Green LED ON (perm. on): Supply connected
(flashing): Start up delay t_a on process
Red LED ERR (flashing): Failure code of the device
Yellow LED BUS (flashing): When receiving or transmitting Modbus data message with matching device address

Yellow LED REL1 (perm. on): On, when output relay 1 activated
(flashing quickly): On delay t_v on process
(flashing): Release delay t_r on process
Yellow LED REL2 (perm. on): On, when output relay 2 activated
(flashing quickly): On delay t_v on process
(flashing): Release delay t_r on process

Failure code *):   9: Communication failure Modbus
10: Checksum failure EEPROM
11: Internal communication failure
12: Checksum failure EEPROM 2
13: Internal error

*) = Number of flashing pulses in sequence

Reset Function

By sending a reset command a reset can be operated via Modbus.

Modbus RTU

For communication between motor controller and a supervising control the Modbus RTU protocol according to Specification V 1.1b3 is used.
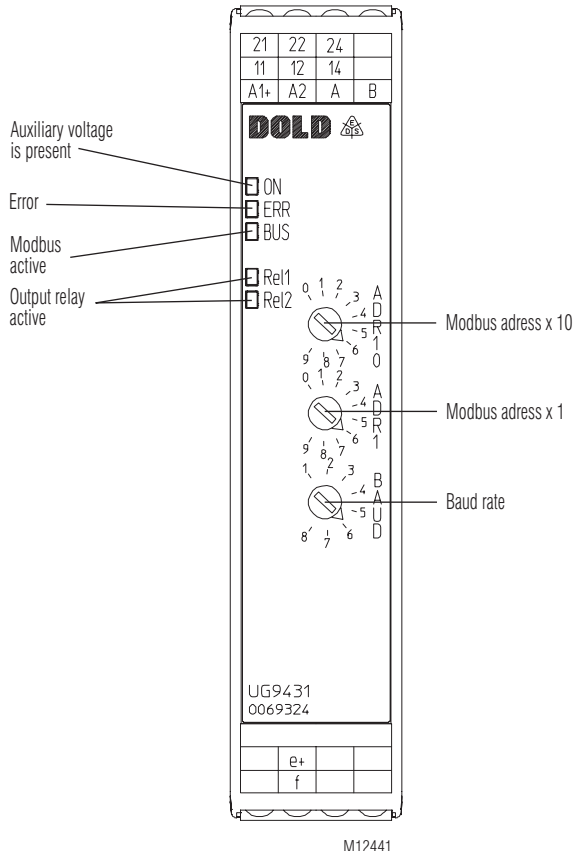
Indicator Outputs

Monitoring parameters can be set independently.
The UG 9431 has 2 relay outputs.
Each monitoring function can be assigned ro relay 1 and / or relay 2.
Relay function energized / de- energized on trip parameterizable.

Setting

M12441

Position Potentiometer BAUD	1	2	3	4	5	6	7	8
Baud rate Baud	1200	2400	4800	9600	19200	38400	57600	115200
Response Time	< 50 ms	< 25 ms	< 10 ms	< 5 ms	< 5 ms	< 5 ms	< 5 ms	< 5 ms

Technical Data

Auxiliary Voltage A1/A2

Nominal auxiliary voltage U_H:	DC 24 V
	The power supply unit must meet the requirements of SELV /PELV
Voltage range:	0.8 ... 1.1 U_H
Nominal consumption:	2 W DC 24 V
Overvoltage protection:	Internal with MOV

Voltage Measuring Input e+, f

Nominal voltage U_N:	DC 20 ... 1000 V
Voltage range:	0.8 ... 1.2 * U_N
Internal resistance:	Approx. 10 MΩ

Setting Range

Setting value:	Adjustable from 20 ... 1150 V, in 0.1 V steps
Measuring accuracy (in % of setting value):	± 2 %
Repeat accuracy:	< ± 0.5 %
Temperature influence:	< 1 %
Hysteresis (in % of setting value):	0.2 ... 50 % of response value
Reaction time:	< 150 ms
Adjustable on delay t_v:	0 ... 100 s (in steps of 0.1 s)
Adjustable release time delay t_r:	0 ... 100 s (in steps of 0.1 s)
Adjustable start up delay t_a:	0.2 ... 100 s (in steps of 0.1 s)

Output Circuit (Rel1: 11/12/14; Rel2: 21/22/24)

Rated output voltage:	AC 230 V	
Contacts:	2 changeover contacts	
Thermal current I_{th}:	2 x 4 A	
Switching capacity to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60947-5-1
To DC 13		
NC contacts:	1 A / DC 24 V	IEC/EN 60947-5-1
Electrical life at 4 A, AC 230 V cos φ = 1:	2 x 10^5 switching cycles	
Short circuit strength **max. fuse rating:**	4 A gG / gL	IEC/EN 60947-5-1
Mechanical life:	≥ x 10^8 switching cycles	

General Data

Nominal operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 60 °C	
Storage:	- 40 ... + 85 °C	
Altitude:	≤ 2000 m	
Clearance and creepage distance rated impulse voltage / pollution degree		
Meas. input / Auxiliay voltage (Bus):	12 kV / 2	IEC/EN 60664-1
Meas. input / Contacts:	12 kV / 2	IEC/EN 60664-1
Auxiliay voltage (Bus) / Contacts:	6 kV / 2	IEC/EN 60664-1
Contacts 11,12,14 / 21,22,24:	6 kV / 2	IEC/EN 60664-1
Within contact path:	1.5 kV / 2	IEC/EN 60664-1
Overvoltage category:	III	IEC/EN 60664-1

Technical Data

EMC	Zone B	IEC/EN 60255-27
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61000-4-2
HF-irradiation 80 MHz ... 6 GHz:	10 V / m	IEC/EN 61000-4-3
Fast transients:	2 kV	IEC/EN 61000-4-4
Surge voltages between wires for power supply:	1 kV	IEC/EN 61000-4-5
Between wire and ground:	2 kV	IEC/EN 61000-4-5
HF-wire guided:	10 V	IEC/EN 61000-4-6
Damped oscillatory wave immunity test Differential mode voltage:	1 kV	IEC/EN 61000-4-18
Common mode voltage:	2.5 kV	IEC/EN 61000-4-18
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	DIN EN 60529
Terminals:	IP 20	DIN EN 60529
Housing:	Thermoplastic with VO behaviour according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Climate resistance:	25 / 060 / 04	IEC/EN 60068-1
Wire connections:		DIN 46228-1/-2/-3/-4
Wire connection Aux. voltage and relay pluggable screw terminal (PS):	0.25 ... 2.5 mm² solid or 0.25 ... 2.5 mm² stranded ferruled	
Wire connection Bus pluggable Twin-cage-clamp-terminal (PT):	0.25 ... 1.5 mm² solid or 0.25 ... 1.5 mm² stranded ferruled	
Insulation of wires or sleeve length:	8 mm	
Fixing torque:	0.5 Nm	
Mounting:	DIN-rail	IEC/EN 60715
Weight:	157 g	

Dimensions

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Width x height x depth:	22.5 x 115 x 120.3 mm

Setting Facilities

Potentiometer ADR10:   - Unit adress x 10

Potentiometer ADR1:   - Unit adress x 1

Potentiometer BAUD: - Baud rate

The module address and baud rate is only read after connecting the auxiliary supply!

Setting and Adjustment

1. Connect device according to application example.
2. Setting unit adress and Baud rate via potentiometer.
3. Power up the unit.
4. Parametrization via Modbus

Connection Examples
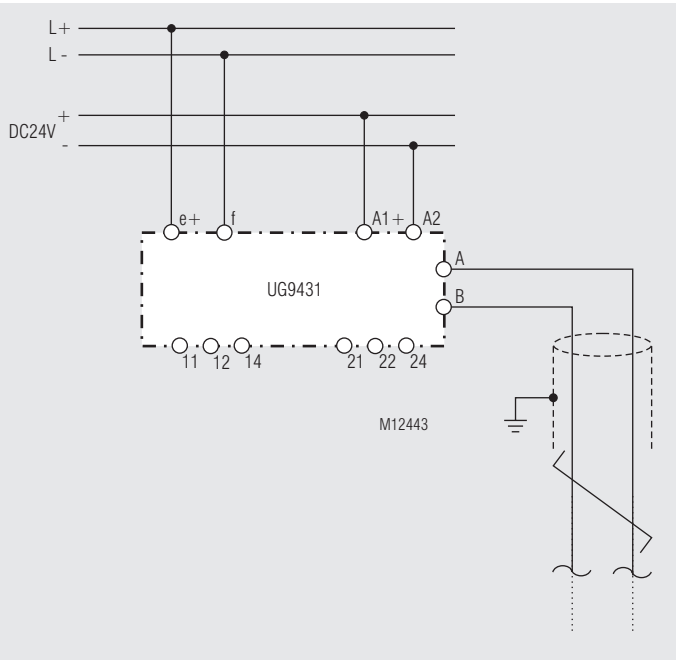
Bus Interface

Protocol	Modbus Seriell RTU
Adress	1 to 99
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
Data bit	8
Stop bit	2
Parity	None

More information about the interface, wiring rules, device identification and communication monitoring can be found in the Modbus user manual.

Function-Codes

At UG 9431 the following function codes are implemented

Function-Code	Name
0x01	Read Coils
0x03	Read Holding Register
0x04	Read Input Register
0x05	Write Single Coil
0x06	Write Single Register
0x10	Write Multiple Register
0x17	Read/Write Multiple Registers

Device configuration

If required the device configuration data can be saved permanently by setting the the Bit "Write configuration to EEPROM". When the auxiliary voltage is applied, the data are copied from the EEPROM into the corresponding holding registers (register block from protocol address 2000). Since the write cycles of an EEPROM are limited, the write process must not be cyclical. In addition, please note that writing the EEPROM takes < 50 ms.

Parameter Table

Coils

Register-Adress	Protocol-Adress	Name	Value range	Initial value	Description	Data type	Access rights
1	0	Reset	0x0000 0xFF00	0x0000	No function Error acknowledgement device error	BIT	Write / read
2	1	Device reset	0x0000 0xFF00	0x0000	No function Device restart	BIT	Write / read
3	2	Write configuration to EEPROM	0x0000 0xFF00	0x0000	No function Save parameters	BIT	Write / read
4	3	Factory setting (after restart of the device)	0x0000 0xFF00	0x0000	No function Factory setting of the parameters	BIT	Write / read
5	4	Reserved	0x0000 0xFF00	0x0000	-	BIT	Write / read
6	5	Fault memory Rel 1	0x0000 0xFF00	0x0000	No function Fault memory acknowledgement relay 1	BIT	Write / read
7	6	Fault memory Rel 2	0x0000 0xFF00	0x0000	No function Fault memory acknowledgement relay 2	BIT	Write / read

Parameter Table

Input Registers

Register-Adresss	Protocol-Adresss	Name	Value range	Description	Data type	Access rights
30001	0	Device failure	0 … 13	0: No failure 9: Communication fault Modbus 10: Checksum failure EEPROM 11: Internal communication fault 12: Checksum failure EEPROM 2 13: Internal fault	UINT16	Read
30002	1	State of device	0 … 3	0: Device initialize 1: Device is ready 2: Device in error mode 3: Device is in the start-up time	UINT16	Read

30003	2	Device flags	0 … 255	Bit 0: Relay 1 energized
				Bit 1: Relay 2 energized
				Bit 2: Measuring voltage present
				Bit 3: Positive measuring voltage
				Bit 4: Negative measuring voltage
				Bit 5: Within measuring range
				        ($16\,V \geq$ voltage measuring input $\leq 1200\,V$)
				Bit 6: Measuring range undershot
				        (voltage measuring input $< 16\,V$)
				Bit 7: Measuring range exceeded
				        (voltage measuring input $> 1200\,V$)
					UINT16	Read

30004	3	State Relay 1	0 … 3	Bit 0: Umin Bit 1: Umax	UINT16	Read
30005	4	Error memory relay 1	0 … 3	Error memory of the status relay 1 register	UINT16	Read
30006	5	State Relay 2	0 … 3	Bit 0: Umin Bit 1: Umax	UINT16	Read
30007	6	Error memory relay 2	0 … 3	Error memory of the status relay 2 register	UINT16	Read

Input Registers

Register-Adress	Protocol-Adress	Name	Value range	Description	Data type	Access rights
32001	2000	DC- voltage	0, 160 ... 12000, 65535	Measuring range undershot 1/10V Measuring range exceeded	UINT16	Read
32002	2001	DC- voltage (signed)	-32768, -12000 ... -160, 0, 160 ... 12000, 32767	Measuring range exceeded 1/10V Measuring range undershot 1/10V Measuring range exceeded	INT16	Read

Parameter Table

Holding Registers

Register-Adress	Protocol-Adress	Name	Value range	Initial value	Description	Data type	Access rights
40001	0	Control word 1	0 … 127	0	Bit 0 = Reset Bit 1 = Device reset Bit 2 = Write configuration to EEPROM Bit 3 = Factory settings (after device restart) Bit 4 = Reserved Bit 5 = Fault memory acknowledgement relay 1 Bit 6 = Fault memory acknowledgement relay 2	UINT16	Write / read
40002	1	Timeout release	0 … 1	0	Bit 0 = Enable	UINT16	Write / read
40003	2	Timeout	100 …10000 0 …10000	1000	Timeout Value in ms (write) Timeout Value in ms (read)	UINT16	Write / read

Register-Adress	Protocol-Adress	Name	Value range	Initial value	Description	Data type	Access rights
42001	2000	Start up time delay	2 … 1000	2	Start-up time delay in 1/10 s	UINT16	Write / read
42002	2001	Relay 1: Umin	200 … 11500	200	Response value Undervoltage 1/10 V	UINT16	Write / read
42003	2002	Relay 1: Umax	200 … 11500	200	Response value Overvoltage 1/10 V	UINT16	Write / read
42004	2003	Relay 1: Response value	0 … 3	0	Bit 0 = Response value Umin On Bit 1 = Response value Umax On	UINT16	Write / read
42005	2004	Relay 1: Hysteresis	2 … 500	40	Hysteresis of the response value 1/10 %	UINT16	Write / read
42006	2005	Relay 1: tv	0 … 1000	0	Response delay 1/10 s	UINT16	Write / read
42007	2006	Relay 1: tr	0 … 1000	0	Release delay 1/10 s	UINT16	Write / read
42008	2007	Relay 1: A / R	0 … 1	0	0: De-energized on trip 1: Energized on trip	UINT16	Write / read
42009	2008	Relay 1: Sp	0 … 1	0	0: Manual reset Off 1: Manual reset On	UINT16	Write / read
42010	2009	Relay 2: Umin	200 … 11500	200	Response value Unterspannung 1/10 V	UINT16	Write / read
42011	2010	Relay 2: Umax	200 … 11500	200	Response value Überspannung 1/10 V	UINT16	Write / read
42012	2011	Relay 2: Response value	0 … 3	0	Bit 0 = Response value Umin On Bit 1 = Response value Umax On	UINT16	Write / read
42013	2012	Relay 2: Hysteresis	2 … 500	40	Hysteresis of the response value 1/10 %	UINT16	Write / read
42014	2013	Relay 2: tv	0 … 1000	0	Response delay 1/10 s	UINT16	Write / read
42015	2014	Relay 2: tr	0 … 1000	0	Release delay 1/10 s	UINT16	Write / read
42016	2015	Relay 2: A / R	0 … 1	0	0: De-energized on trip 1: Energized on trip	UINT16	Write / read
42017	2016	Relay 2: Sp	0 … 1	0	0: Manual reset Off 1: Manual reset On	UINT16	Write / read

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