DATA SHEET

Grid feeding monitoring according to VDE-AR-N 4105, VDE-AR-N 4110 and VDE-AR-N 4120

CM-UFD.M31

CM-UFD.M31M with Modbus RTU

Now with ABB Ability™

The CM-UFD.M31(M) with Modbus RTU is a multifunctional grid feeding monitoring relay. It provides different monitoring functions in accordance with VDE-AR-N 4105, VDE-AR-N 4110 and VDE-AR-N 4120 to detect over- and undervoltage (10-minutes average value, voltage increase and decrease protection) as well as any changes in grid frequency (frequency increase and decrease protection).

The device is connected between the distributed generation and the public grid in order to disconnect the distributed generation in case of problems (e.g. unstable grid), faults or maintenance on the grid. Additionally, monitoring of ROCOF (rate of change of frequency) and vector shift can be configured.

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Characteristics

- Monitoring of voltage and frequency in single- and three-phase mains (2-wire, 3-wire or 4-wire AC systems)
- Type-tested in accordance with VDE-AR-N 4105, VDE-AR-N 4110 and VDE-AR-N 4120
- Pre-settings in accordance with VDE-AR-N 4105 and VDE-AR-N 4110
- Possibility to adjust settings in accordance to the VDE-AR-N-4120 recommended values
- Note on VDE-AR-N 4110:2018-11:
  Can be used as subordinate end coupling protection and as higher-level end coupling protection if no Q-U protection is required
- Integrated management of redundancy function (acc. to VDE-AR-N 4105, mandatory in plants with P>30 kW)
- Modbus RTU communication interface*
- Multiline, backlit LCD display
- True RMS measuring principle
- Over- and undervoltage, 10-minutes average value as well as over- and underfrequency monitoring
- Two-level threshold settings for over-/undervoltage and over-/underfrequency
- ROCOF (rate of change of frequency) monitoring and vector shift configurable
- Interrupted neutral detection
- All threshold values and tripping delays adjustable
- Error memory for up to 99 entries (incl. cause of error, measured value, relative timestamp)
- Test function
- Password setting protection
- 3 control inputs, e.g. for feedback signal, remote trip
- 3 c/o (SPDT) contacts
- Can be connected to ABB Ability™ Electrical Distribution Control System (see EDCS Getting Started, document no. 1SDC200063B0204)*
- Various certifications and approvals (see overview, document no. 2CDC112249D0201)
- Suitable for installation on the low-voltage side of MV/HV networks

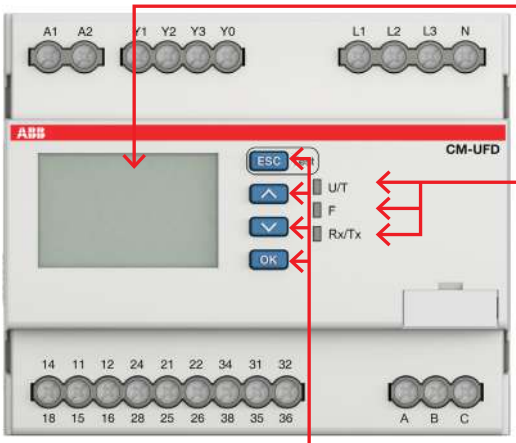
Ordering details

Type	Rated control supply voltage	Measuring range	Order code
CM-UFD.M31M	24-240 V AC/DC	L-L: 0-540 V AC / L-N: 0-312 V AC	1SVR560731R3701
CM-UFD.M31	24-240 V AC/DC	L-L: 0-540 V AC / L-N: 0-312 V AC	1SVR560730R3401

* For CM-UFD.M31M only

Functions

Operating controls



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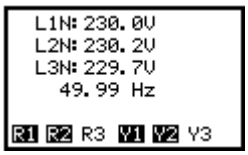
Display



R1 R2 R3: relay status; in this case R3 is de-energized
Y1: status feedback loop Y1-Y0
Y2: status feedback loop Y2-Y0
Y3: status control input Y3-Y0, in this case Y3-Y0 is open

Indication of operational states

U/T: green LED - ⎍ Control supply voltage applied
⎍⎍ Timing
F: red LED - Fault message
Rx/Tx: yellow LED - Modbus frame reception and transmission

Keypad

ESC: escape / return to previous menu
∧: up / value increase
∨: down / value decrease
OK: enter / confirm selection

Application

The CM-UFD.M31(M) is a multi-functional grid feeding monitoring relay which is installed between the renewable energy system such as photovoltaic systems, wind turbines, block-type thermal power stations and the public grid. The innovative relay guarantee grid stability and prevent blackouts. If the public grid's voltage or frequency moves out of the permitted ranges, the device uses a decoupling unit (e.g. contactor or circuit breaker) to separate the renewable energy system from the public grid. As soon as the grid is stable again, the system is automatically reconnected.

The fault is indicated by LED and the corresponding plain text message is shown on the display. In conformity with VDE-AR-N 4105, the CM-UFD.M31(M) relay can be used in all renewable power plants > 30 kW. Furthermore, it is suitable for installation on the low-voltage side of MV/HV networks.

Operating mode

The CM-UFD.M31(M) can be set up to monitor single- and three-phase mains (2-wire, 3-wire as well as 4-wire AC systems). The unit is configurable by front-face push-buttons. A display with the corresponding menu enables the selection of presettings as well as the precise adjustment of the different threshold values and corresponding time delays. Furthermore, the display visualizes the measured values clearly. Together with the front-face LEDs, it shows all information about operational states of output relays and control inputs. With the Modbus RTU interface, all process values and status information from the CM-UFD.M31(M) can be read out and control commands can be executed.*

The CM-UFD.M31(M) provides 3 output relays and 3 control inputs. Output relays R1 (11_{15}-12_{16}/14_{18}) and R2 (21_{25}-22_{26}/24_{28}) are required for disconnection of a distributed generation from the public grid. The corresponding feedback signals from the external contacts are monitored via the control inputs Y1-Y0 and Y2-Y0. The third output relay R3 (31_{35}-32_{36}/34_{38}) can be used for signalization of an event in the grid or a bus fault or the closing command of a motor drive for circuit breaker or switch disconnector. Typically, it is often used to send a signal to the inverter in the event of a fault. Additionally, it can be configured to act synchronously with R1/R2 or controlled via bus.

The control inputs Y1-Y0 and Y2-Y0 monitor the corresponding feedback signals from the first and the second switching device. The third control input Y3-Y0 allows to trip the grid feeding monitoring relay (remote trip), to suppress Y1, to suppress Y2, to suppress Y1/Y2 or to suppress the vector shift detection.

* For CM-UFD.M31M only

Protective functions

If control supply voltage is applied, all phases are present and the switch-on conditions for voltages and frequency are fulfilled, output relays R1 and R2 energize synchronously after the adjusted switch-on delay. The green LED U/T flashes while timing and turns steady when the switch-on delay is complete.

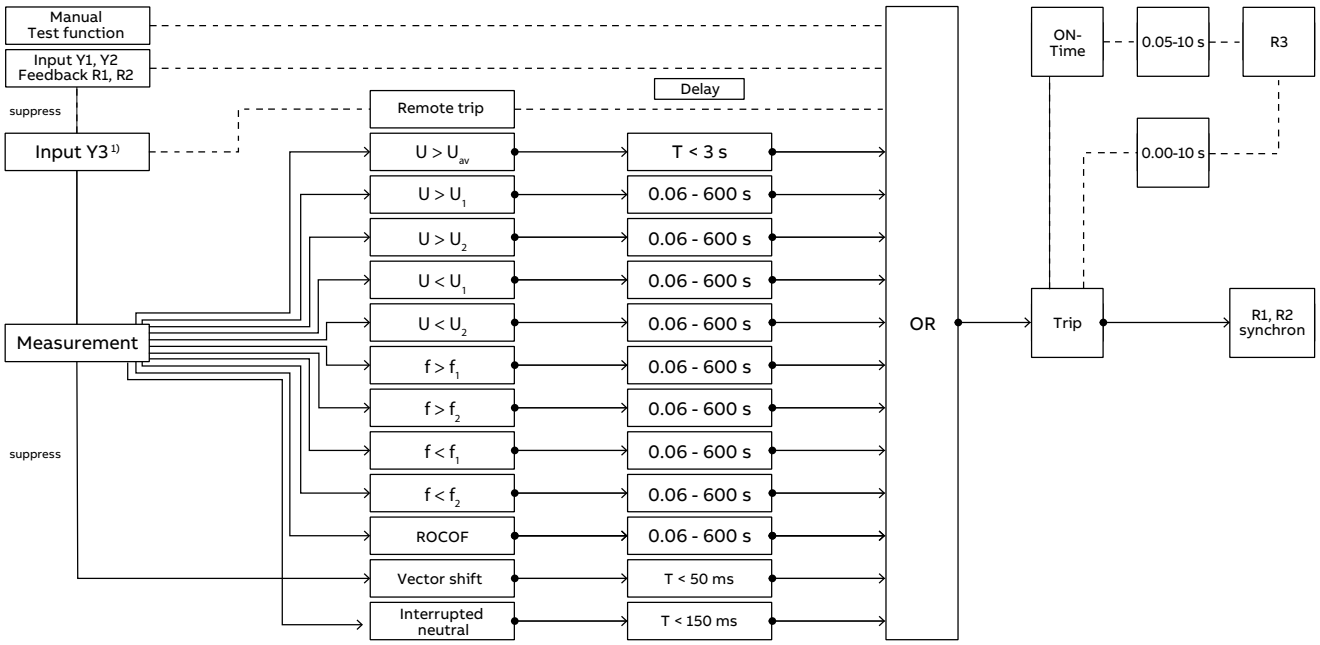
If a measured value exceeds or falls below the set threshold value (overvoltage, undervoltage, overfrequency or underfrequency), R1 and R2 de-energize after the adjusted tripping delay. As soon as the measured value returns to the tolerance range - taking into account an adjustable hysteresis – and all further switch-on conditions are fulfilled, R1 and R2 re-energize. The fault is indicated by the red LED F and the type of fault is shown on the display as a plain text message. The event that has caused tripping of the relay is recorded in the event list. The green LED U/T flashes while timing and turns steady when the delay is complete.

Output relay R3 (31_{35}-32_{36}/34_{38})

The output relay R3 can be used for:

- Trip signalization
  R3 reacts synchronously with R1/R2. ON-time of R3 is inactive.
- Closing command of a breaker motor
  In case output relays R1 and R2 energizes, the adjusted ON-delay starts. When timing is complete, output relay R3 will be activated for the duration of the ON-time or until relay R1 and R2 de-energizes.
- Bus fault signalization
  In case of no bus communication during the adjusted bus timeout, the bus fault is signalized by R3 (e.g. no sign of life from the bus master)
- Additionally the control of R3 via bus or a deactivation is possible. With these configurations the settings for the ON-delay and the ON-time have no influence on the operating function.
- To send a signal to the inverter in the event of a fault

Operating principle



1) Depending on individual configuration

Monitoring functions

The device utilises several separately adjustable monitoring functions for:

- Over voltage protection: > U_{AV}, > U1, > U2
- Under voltage protection: < U1, < U2
- Over frequency protection: > F1, > F2
- Under frequency protection: < F1, < F2

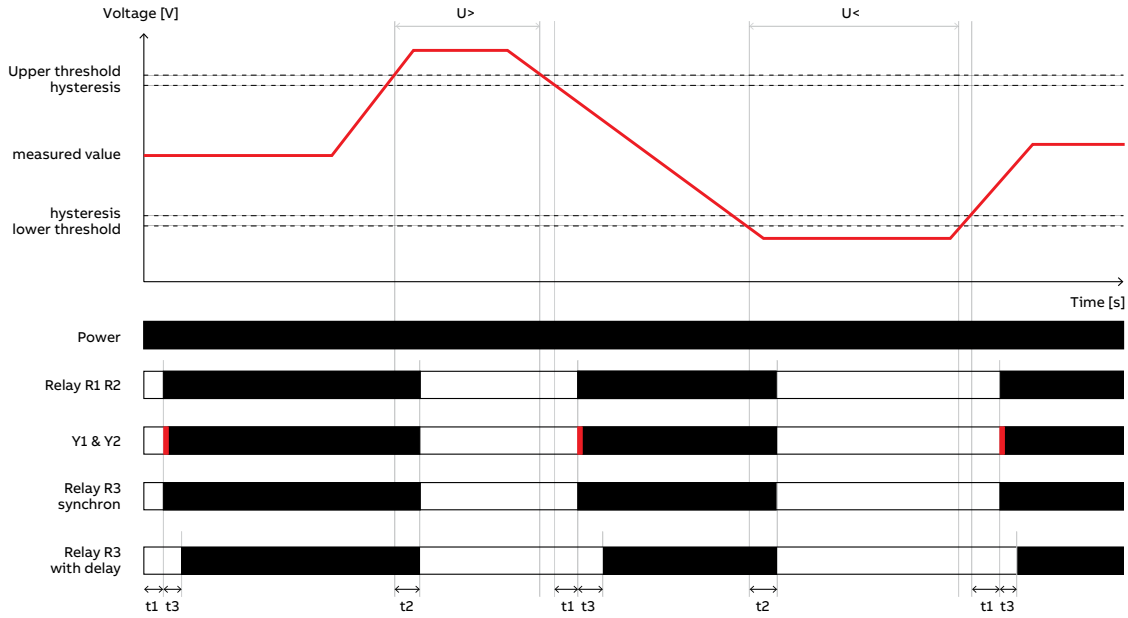
Protective function UAV (10-minutes average value):
The CM-UFD.M31(M) calculates the sliding average value of the 3 phases over a period of 10 minutes. The voltage values are updated every 3 seconds. If the 10-minutes average value exceeds the threshold value, the output relays trip.

ANSI codes for monitoring functions

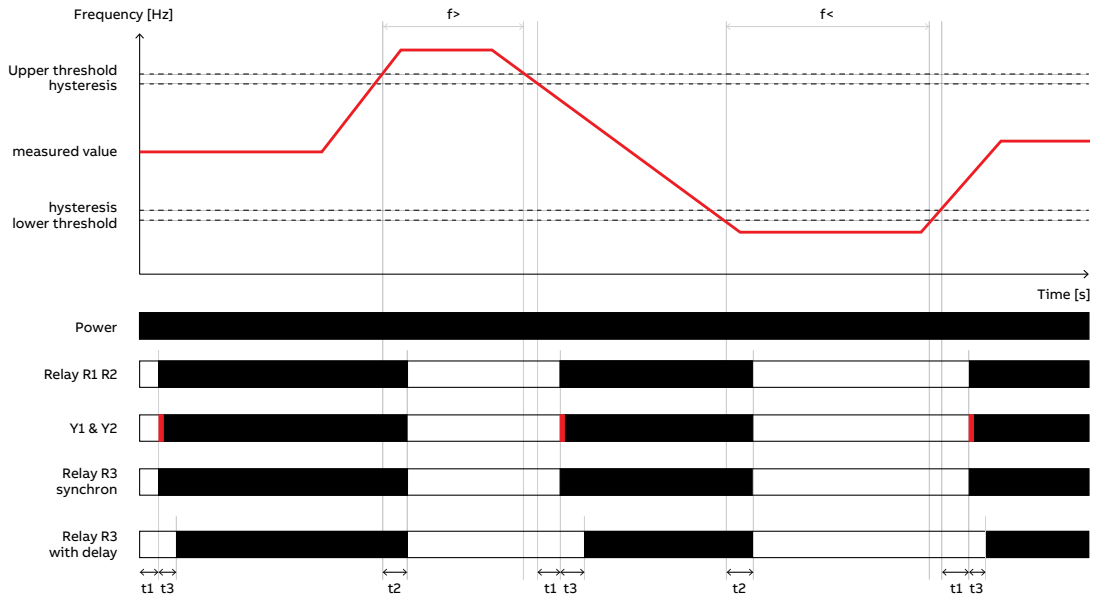
Monitoring function	ANSI code
Overvoltage (>U1,>U2,>U_{av})	59
Undervoltage (<U1,<U2)	27
Overfrequency (>F1,>F2)	81O
Underfrequency (<F1,<F2)	81U
Vectorshift	78
ROCOF	81R

Timing diagrams for relay operation

Over-/under voltage event detection

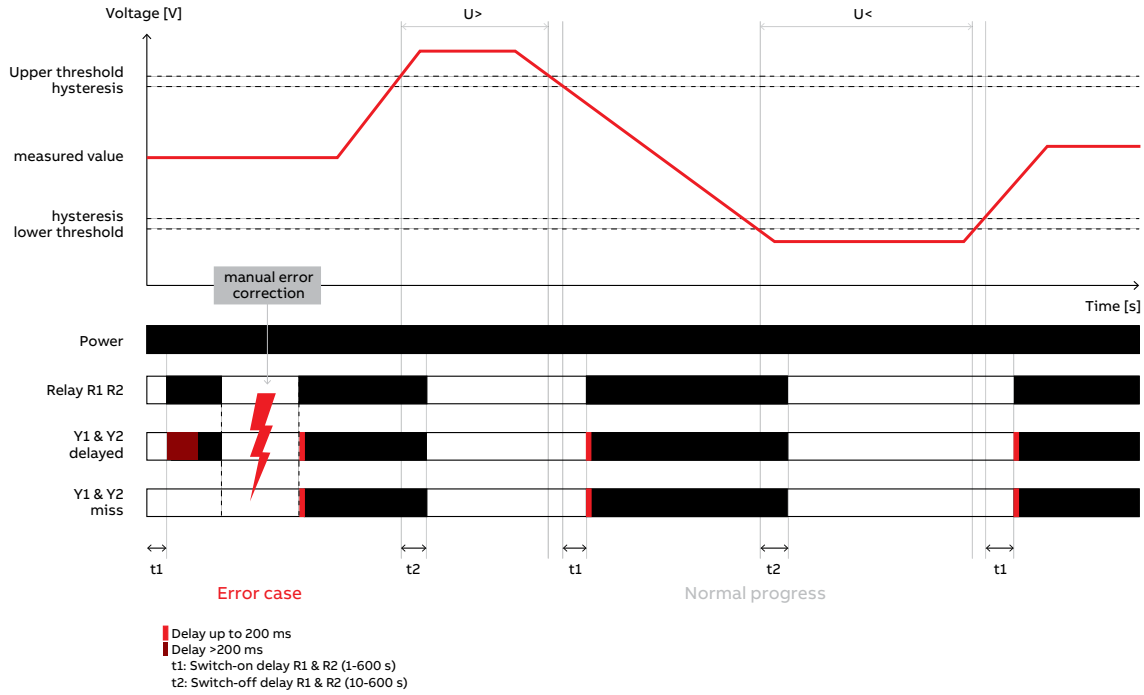


Over-/under frequency event detection



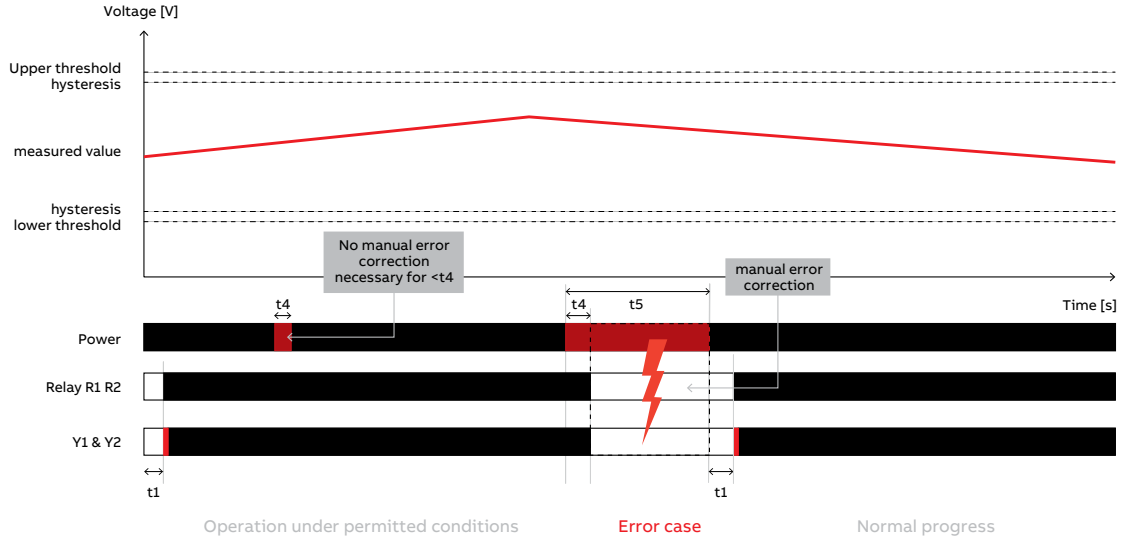
Delay up to 200 ms
t1: Switch-on delay R1 & R2 (1-600 s)
t2: Switch-off delay R1 & R2 (10-600 s)
t3: Switch-on delay R3 (0-10 s)

Failure in feedback signals (Y1-Y0, Y2-Y0)



Delay up to 200 ms
Delay >200 ms
t1: Switch-on delay R1 & R2 (1-600 s)
t2: Switch-off delay R1 & R2 (10-600 s)

Failure in power supply of relay



Power supply failure

Delay up to 200 ms
t1: Switch-on delay R1 & R2 (1-600 s)
t2: Switch-off delay R1 & R2 (10-600 s)
t4: delay up to 200 ms (110 - 240 V AC) or 10 ms (24 V AC/DC)
t5: delay > t4

Note:
In case of voltage drop, the supply of the contactors must be ensured **separately!**

Control inputs Y1-Y0, Y2-Y0

Both control inputs Y1-Y0 and Y2-Y0 are used as feedback contacts for the 2 switching devices of the section switch. The current status of the switching devices is monitored by the grid feeding monitoring relay. The function of these control inputs can be configured as “disabled“, “enabled“ or “tripping only“ The working principle of the control inputs can be configured as “normally closed”, “normally open” or “auto detection”. Please note that “normally” here refers to “good status” of the grid, when all the monitored voltages and the frequency stay within the set threshold values and output relays R1 and R2 are energized. A failure in the feedback loop has to be removed manually on the device.

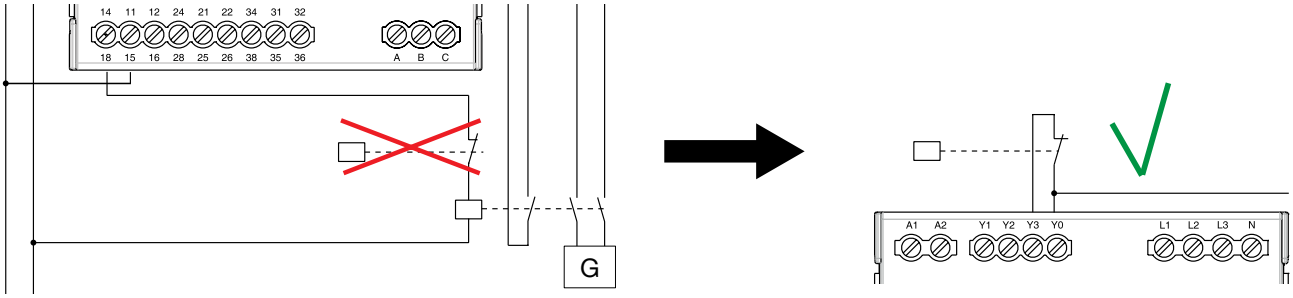
Control input Y3-Y0

The function of control input Y3-Y0 can be configured as “remote trip”, “suppress Y1”, “suppress Y2”, “suppress Y1/Y2”, “suppress vector shift detection” or completely “disabled”. Working principle of the control input can be configured as “normally open” or “normally closed”.

Remote trip: With Y3-Y0 configured as “normally closed”, output relays R1 and R2 de-energize if Y3-Y0 is opened, and vice versa.

Suppress Y1, suppress Y2, suppress Y1/Y2: These functions can be used to suppress evaluation of the chosen feedback loop during synchronization of a generator, so that the status of the feedback signal will not be considered as a feedback error. An alternative solution is to set the release window of the corresponding feedback loop larger than the possible duration of synchronization process.

Y3-Y0 wiring schematic



Remote trip

The Modbus RTU and the control input Y3-Y0 allow remote tripping of the grid feeding monitoring relay. The remote trip input can be configured as normally open or normally closed. If normally closed is configured, the relay trips if Y3-Y0 is opened. If normally open is configured, the relay trips if Y3-Y0 is closed. The output relay R1 is tripped by the remote trip within less than 20 ms. When the remote trip input is deactivated, the output relay R1 energizes again.

ROCOF (Rate of change of frequency df/dt)

This function monitors the rate of change of frequency within a very short time and detects an imminent loss of mains (islanding). The ROCOF function detects zero crossings of the grid voltages. It measures the time between the zero crossings and calculates a new frequency after each zero crossing. In case the frequency changes too much since the last zero crossing, the output relay R1 trips. After the adjusted error time the relay de-energizes automatically.

The ROCOF monitoring function is deactivated per default and must be activated in the menu.

Vector shift detection

This function is another possibility of detecting a loss of mains (islanding).

The vector shift detection is disabled by default and can be manually enabled in the menu. Through zero crossings the device detects the vector shift of mains voltage and de-energizes output relays R1 immediately if the shift exceeds the adjusted threshold value, e.g. 10 °. Only after the set error time the switch-on conditions will be evaluated in order to start an auto reconnection.

Switch-on conditions

In order to switch on the section switch after having applied control supply voltage or after a fault, the voltages as well as the frequency must stay within the set switch-on conditions during the switch-on delay. This window of voltage and frequency can be further restricted in the menu “Switch-on conditions”. If one parameter leaves the window, the switch-on process is interrupted. When all parameters fulfill the switch-on conditions again, the switch-on delay restarts. When the switch-on time is complete, relays R1 and R2 re-energize automatically. If the function “Short interruption” is enabled in the menu “Switch-on conditions” -> “Switch-on delay”, the switch-on delay will be reduced to 5 s in case of a short interruption of < 3 s.

Interrupted neutral detection

Interrupted neutral detection is always active when a phase-neutral measuring principle is selected in the menu “Nominal voltage”. The interruption of the neutral conductor will result in an immediate tripping of output relays R1 and R2.

Automatic reconnecting attempts

If an error occurs at feedback loop Y1-Y0 or Y2-Y0 (e.g. undervoltage release because of a lightning strike), 0, 1, 2 or 3 automatic reconnecting attempts will be carried out , taking into account the switch-on conditions. Therefore a temporary feedback error doesn’t have to be handled manually. The corresponding error in the feedback loop is stored in the error list. By default the number of automatic reconnection attempts is set to 0 and can be manually adjusted to maximum of 3.

Error memory

The CM-UFD.M31(M) records and logs the last 99 events that caused tripping of the grid feeding monitoring relay as well as any interruption of the control supply voltage. The type of error as well as the current value of the operation counter is recorded into the internal error list, accessible via the menu. The list is stored internally in a non-volatile memory which can be reset by the user.

Test function

The test function can be used to simulate an error in the installation. This way, the time delays of the feedback loops can be determined. A feedback loop includes the output relay, the corresponding switching device and the feedback contact.

The test function can be started by pressing the ESC button for 3 seconds. The output relays R1 and R2 de-energize immediately and the CM-UFD.M31(M) gets feedback signals from the section switch through control inputs Y1-Y0 and Y2-Y0 respectively. The time intervals from de-energizing both output relays to receiving both feedback signals is shown on the display. Return to the menu is realized by confirming with the OK button.

Password protection

In order to meet the requirements of VDE-AR-N 4105, each CM-UFD.M31(M) offers the possibility of a two-stage password protection. The relay is supplied with the standard passwords [0000] to protect its settings. The installer/plant operator is responsible for checking the parameter values and changing the password with a personal one to avoid unwanted changes.

The installer/plant operator has the possibility to set all standard-related as well as non-standard related parameters, such as Modbus function etc., and protect them from unauthorized access by setting the password „A“ (plant operator).

While the renewable power plant is connected to the public grid, the grid operator can adjust the grid-related parameters and protect them with a separate password „B“ (grid operator).

The visualization of the parameters is possible at any time, changes are possible only after entering the password. While entering the password, the password protection is temporarily disabled until the menu is exited. Only the parameters ‚Autotest‘, ‚Language‘, ‚Display switch-off delay‘ and ‚Contrast‘ are not password-protected.

Modbus RTU*

This communication interface enables control commands (remote trip) to the CM-UFD.M31M and provides status information as well as actual process values.

RS-485 Standard

RS-485 is a serial interface standard for communication over a twisted-pair cable. The RS-485 standard specifies only the electrical characteristics of the bus system. The RS-485 transmission line consists of three wires: A, B and C. The signal transmission is based on the voltage difference between the wires. The isolated signal ground should be connected to prevent common mode voltage between the network devices from drifting outside the allowable limits. RS-485 bus cable should be terminated with a resistor on both ends to prevent signal reflection.

Network characteristics

Bus termination is required to prevent signal reflections from the bus cable ends. The CM-UFD.M31M is not equipped with internal bus termination, therefore external termination resistors have to be used according to Modbus specifications. The Modbus slave address, baud rate and communication timeout can be set in the CM-UFD.M31M. It is possible to configure a maximal time without telegrams from the master before the CM-UFD.M31M triggers the configured bus fault reaction. Per default, a timeout of 10 s is set. When changing communication parameters, no power cycle is necessary.

Cable type and cable length have to be selected according to the Modbus specification. The use of passive bus sublines should be avoided. For integrating the CM-UFD.M31M into an ethernet network, such as Modbus TCP/IP, an ethernet gateway can be used.

Configuration of the Modbus RTU communication menu

- The bus address can be adjusted with the CM-UFD.M31M menu. The CM-UFD.M31M allows an address to be set between 001 and 247.
- For Modbus RTU it is necessary to configure at least the baud rate and the parity.

Bus fault reaction

- The bus fault reaction can be set the following ways:
- Trip R1 and R2 - Disconnection of the distributed generation from the grid
- Signalization of a bus fault via R3
- Signalization of a bus fault via fault message in the display

* For CM-UFD.M31M only

ABB Ability™ Electrical Distribution Control System

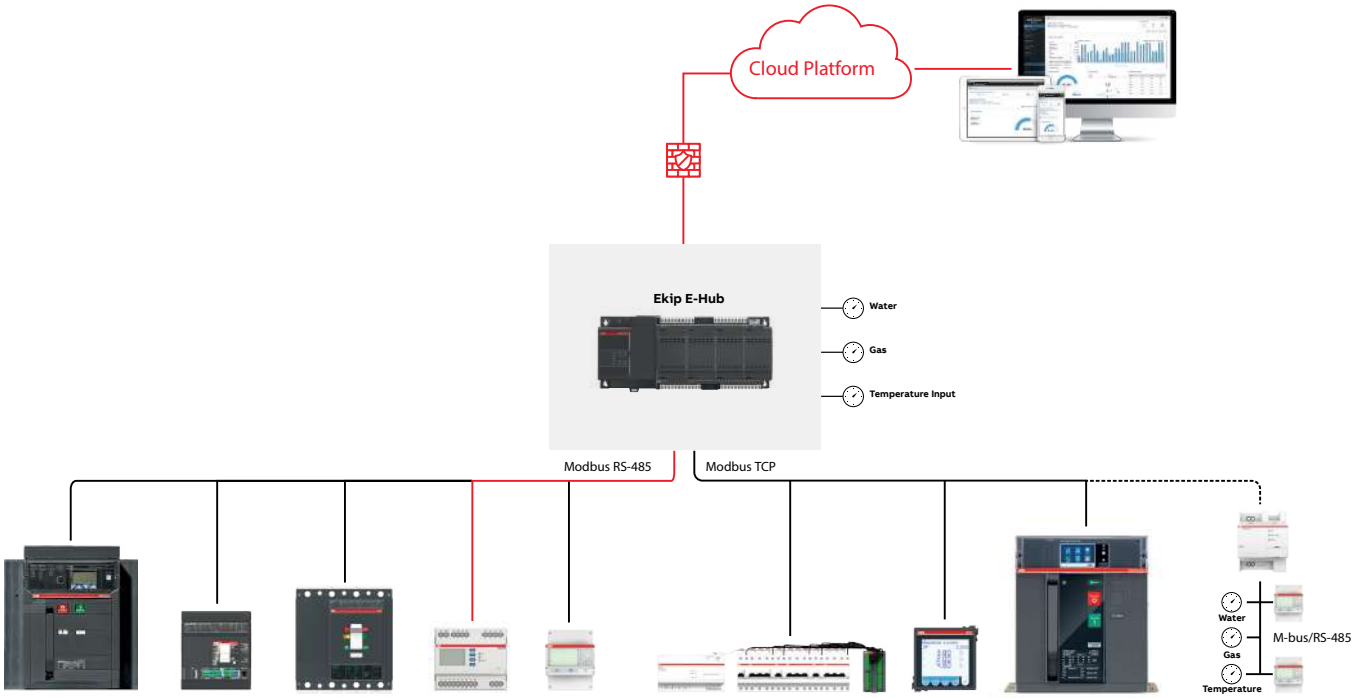
Over Modbus RTU the CM-UFD.M31M can be connected to the ABB Ability™ Electrical Distribution Control System.

ABB Ability™ Electrical Distribution Control System is built on a state-of-the-art cloud architecture for data collection, processing and storage.

Following information are available in the cloud:
- All measured values (e.g. frequency and voltage)
- I/O Data (e.g. state of relays)
- Diagnostic data (e.g. Last trip reason)

For the initial setup please see "Ekip Com Hub Getting Started" (1SDC200063B0204)

For a detailed integration of the CM-UFD.M31M into ABB Ability™, please see the application note (2CDC112278D0201).



Modbus Address Map*

Register map

Measuring, read only (FC03, FC04)

Address	Register	Value	Format
0x0000	1	Device Type	31 = CM-UFD.M31M
0x0001	2	Average voltage L1-N	1 Bit = 10 mV
0x0002	3	Average voltage L2-N	1 Bit = 10 mV
0x0003	4	Average voltage L3-N	1 Bit = 10 mV
0x0004	5	Average voltage L1-L2	1 Bit = 10 mV
0x0005	6	Average voltage L2-L3	1 Bit = 10 mV
0x0006	7	Average voltage L3-L1	1 Bit = 10 mV
0x0007	8	Voltage L1-N	1 Bit = 10 mV
0x0008	9	Voltage L2-N	1 Bit = 10 mV
0x0009	10	Voltage L3-N	1 Bit = 10 mV
0x000A	11	Voltage L1-L2	1 Bit = 10 mV
0x000B	12	Voltage L2-L3	1 Bit = 10 mV
0x000C	13	Voltage L3-L1	1 Bit = 10 mV
0x000D	14	Frequency	1 Bit = 10 mHz
0x000E	15	Last trip reason	see table "Last trip reasons Modbus RTU"
0x000F	16	Trip counter	0-65535

Status bits, read only (FC03, FC04)

Address	Register	MSB						Coil no.									LSB
0x0010	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0x0011	18	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
0x0012	19	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
0x0013	20	64	63	62	61	60	59	58	57	56	55	54	53	52	51	40	49
0x0014	21	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65

Commands, read/write (FC03, FC04, FC06, FC16)

Address	Register	MSB						Coil no.									LSB
0x0015	22	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81

* For CM-UFD.M31M only

Coils map

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Status coils at register 17, read only (FC01, FC02)

Address	Coil	CM-UFD.M31M	Description
0x0000	1	Error summary	1, if any coil from 17 to 80 is 1
0x0001	2	Restart delay	No error, restart delay running
0x0002	3	Relay 1	Relay status, 1 = energized
0x0003	4	Relay 2	Relay status, 1 = energized
0x0004	5	Relay 3	Relay status, 1 = energized
0x0005	6	Input Y1	Input status, 1 = closed
0x0006	7	Input Y2	Input status, 1 = closed
0x0007	8	Input Y3	Input status, 1 = closed
0x0008	9	Frequency value invalid	1 = value invalid
0x0009	10	-	-
0x000A	11	-	-
0x000B	12	-	-
0x000C	13	-	-
0x000D	14	-	-
0x000E	15	-	-
0x000F	16	-	-

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Status coils at register 18, read only (FC01, FC02)

Address	Coil	CM-UFD.M31M	Description
0x0010	17	OV1 L1-N	Overvoltage 1, L1-N
0x0011	18	OV1 L2-N	Overvoltage 1, L2-N
0x0012	19	OV1 L3-N	Overvoltage 1, L3-N
0x0013	20	OV2 L1-N	Overvoltage 2, L1-N
0x0014	21	OV2 L2-N	Overvoltage 2, L2-N
0x0015	22	OV2 L3-N	Overvoltage 2, L3-N
0x0016	23	UV1 L1-N	Undervoltage 1, L1-N
0x0017	24	UV1 L2-N	Undervoltage 1, L2-N
0x0018	25	UV1 L3-N	Undervoltage 1, L3-N
0x0019	26	UV2 L1-N	Undervoltage 2, L1-N
0x001A	27	UV2 L2-N	Undervoltage 2, L2-N
0x001B	28	UV2 L3-N	Undervoltage 2, L3-N
0x001C	29	OVAV L1-N	Overvoltage 10 min average L1-N
0x001D	30	OVAV L2-N	Overvoltage 10 min average L2-N
0x001E	31	OVAV L3-N	Overvoltage 10 min average L3-N
0x001F	32	-	-

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Status coils at register 19, read only (FC01, FC02)

Address	Coil	CM-UFD.M31M	Description
0x0020	33	OV1 L1-L2*	Overvoltage 1, L1-L2
0x0021	34	OV1 L2-L3*	Overvoltage 1, L2-L3
0x0022	35	OV1 L3-L1*	Overvoltage 1, L3-L1
0x0023	36	OV2 L1-L2	Overvoltage 2, L1-L2
0x0024	37	OV2 L2-L3	Overvoltage 2, L2-L3
0x0025	38	OV2 L3-L1	Overvoltage 2, L3-L1
0x0026	39	UV1 L1-L2	Undervoltage 1, L1-L2
0x0027	40	UV1 L2-L3	Undervoltage 1, L2-L3
0x0028	41	UV1 L3-L1	Undervoltage 1, L3-L1
0x0029	42	UV2 L1-L2	Undervoltage 2, L1-L2
0x002A	43	UV2 L2-L3	Undervoltage 2, L2-L3
0x002B	44	UV2 L3-L1	Undervoltage 2, L3-L1
0x002C	45	OVAV L1-L2	Overvoltage 10 min average L1-L2
0x002D	46	OVAV L2-L3	Overvoltage 10 min average L2-L3
0x002E	47	OVAV L3-L1	Overvoltage 10 min average L3-L1
0x002F	48	-	-

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Status coils at register 20, read only (FC01, FC02)

Address	Coil	CM-UFD.M31M	Description
0x0030	49	OF1	Overfrequency 1
0x0031	50	OF2	Overfrequency 2
0x0032	51	UF1	Underfrequency 1
0x0033	52	UF2	Underfrequency 2
0x0034	53	ROCOF	Rate of change of frequency
0x0035	54	VECTOR	Vector shift
0x0036	55	REMOTE	Remote trip via Y3
0x0037	56	NEUTRAL	Neutral conductor broken
0x0038	57	FEEDBACK 1	Feedback error Y1
0x0039	58	FEEDBACK 2	Feedback error Y2
0x003A	59	-	-
0x003B	60	INTERNAL	Internal error
0x003C	61	TEST	Trip test (via LCD panel)
0x003D	62	BUS TRIP	Remote trip via BUS
0x003E	63	BUS FAULT	Bus fault (timeout)
0x003F	64	-	-

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Status coils at register 21, read only (FC01, FC02)

Address	Coil	CM-UFD.M31M	Description
0x0040	65	OVON L1-N	Overvoltage switch on, L1-N
0x0041	66	OVON L2-N	Overvoltage switch on, L2-N
0x0042	67	OVON L3-N	Overvoltage switch on, L3-N
0x0043	68	OVON L1-L2	Overvoltage switch on 1, L1-L2
0x0044	69	OVON L2-L3	Overvoltage switch on 1, L2-L3
0x0045	70	OVON L3-L1	Overvoltage switch on 1, L3-L1
0x0046	71	UVON L1-N	Undervoltage switch on, L1-N
0x0047	72	UVON L2-N	Undervoltage switch on, L2-N
0x0048	73	UVON L3-N	Undervoltage switch on, L3-N
0x0049	74	UVON L1-L2	Undervoltage switch on 1, L1-L2
0x004A	75	UVON L2-L3	Undervoltage switch on 1, L2-L3
0x004B	76	UVON L3-L1	Undervoltage switch on 1, L3-L1
0x004C	77	OFON	Overfrequency switch on
0x004D	78	UFON	Underfrequency switch on
0x004E	79	-	-
0x004F	80	-	-

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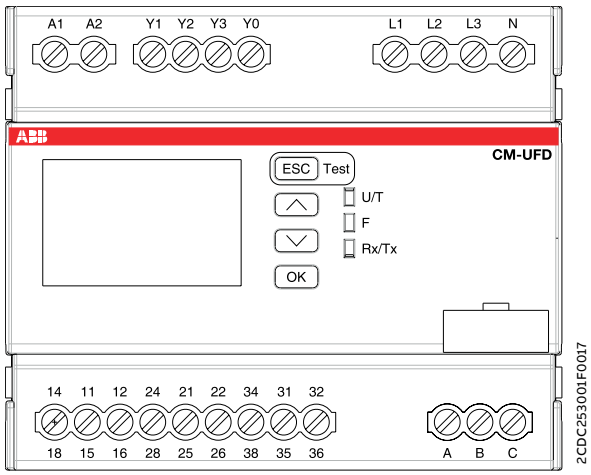
Command coils at register 22, read/write (FC01, FC02, FC05, FC15)

Address	Coil	CM-UFD.M31M	Description
0x0050	81	TRIP R1	Trip error relays
0x0051	82	TRIP R3	Trip relay R3
0x0052	83	-	-
0x0053	84	SUPPRESS Y1	Suppress Y1 feedback monitoring
0x0054	85	SUPPRESS Y2	Suppress Y2 feedback monitoring
0x0055	86	SUPPRESS VS	Suppress vector shift monitoring
0x0056	87	-	-
0x0057	88	-	-
0x0058	89	-	-
0x0059	90	-	-
0x005A	91	-	-
0x005B	92	-	-
0x005C	93	-	-
0x005D	94	-	-
0x005E	95	-	-
0x005F	96	-	-

Last trip reasons Modbus RTU

Dezimal	HEX	Comment
0	0x00	Overvoltage L1-N, threshold 1
1	0x01	Overvoltage L2-N, threshold 1
2	0x02	Overvoltage L3-N, threshold 1
3	0x03	Overvoltage L1-N, threshold 2
4	0x04	Overvoltage L2-N, threshold 2
5	0x05	Overvoltage L3-N, threshold 2
6	0x06	Undervoltage L1-N, threshold 1
7	0x07	Undervoltage L2-N, threshold 1
8	0x08	Undervoltage L3-N, threshold 1
9	0x09	Undervoltage L1-N, threshold 2
10	0x0A	Undervoltage L2-N, threshold 2
11	0x0B	Undervoltage L3-N, threshold 2
12	0x0C	Overvoltage L1-N, average value
13	0x0D	Overvoltage L2-N, average value
14	0x0E	Overvoltage L3-N, average value
15	0x0F	Overvoltage L1-L2, threshold 1
16	0x10	Overvoltage L2-L3, threshold 1
17	0x11	Overvoltage L3-L1, threshold 1
18	0x12	Overvoltage L1-L2, threshold 2
19	0x13	Overvoltage L2-L3, threshold 2
20	0x14	Overvoltage L3-L1, threshold 2
21	0x15	Undervoltage L1-L2, threshold 1
22	0x16	Undervoltage L2-L3, threshold 1
23	0x17	Undervoltage L3-L1, threshold 1
24	0x18	Undervoltage L1-L2, threshold 2
25	0x19	Undervoltage L2-L3, threshold 2
26	0x1A	Undervoltage L3-L1, threshold 2
27	0x1B	Overvoltage L1-L2, average value
28	0x1B	Overvoltage L2-L3, average value
29	0x1C	Overvoltage L3-L1, average value
30	0x1E	Overfrequency, threshold 1
31	0x1F	Overfrequency, threshold 2
32	0x20	Underfrequency, threshold 1
33	0x21	Underfrequency, threshold 2
34	0x22	ROCOF
35	0x23	Vector shift
36	0x24	Remote trip via Y3
37	0x25	Interrupted neutral detection
38	0x26	Failure in feedback loop 1, feedback switching device 1
39	0x27	Failure in feedback loop 2, feedback switching device 2
40	-	-
41	0x29	Internal error
42	0x2A	Test
43	0x2B	Remote trip via bus
44	0x2C	Bus fault
255	0xFF	No error after power on

Electrical connection



A1-A2	Control supply voltage
Y1-Y0	Control input 1, for feedback from switching device 1
Y2-Y0	Control input 2, for feedback from switching device 2
Y3-Y0	Control input 3, configurable
L1, L2, L3, N	Measuring input
11_{15}-12_{16}/14_{18}	Relay R1, c/o (SPDT) contact
21_{25}-22_{26}/24_{28}	Relay R2, c/o (SPDT) contact
31_{35}-32_{36}/34_{38}	Relay R3, c/o (SPDT) contact
A, B, C	Modbus RTU interface A / D0 B / D1 C / Common*

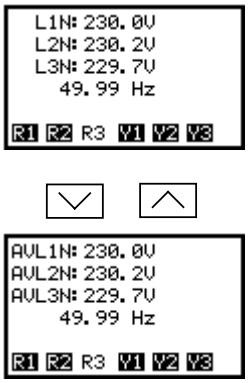
* For CM-UFD.M31M only

Configuration

The CM-UFD.M31(M) is delivered with default settings in accordance to the VDE-AR-N 4105 and VDE-AR-N 4110. The default values in accordance to VDE-AR-N 4120 may be manually set. The menu structure starts with the main page that shows the real time measured values. Use the arrow keys to switch between the real time voltages and the 10-minutes average voltages.

Display menu structure, navigation and possible configurations

Main page



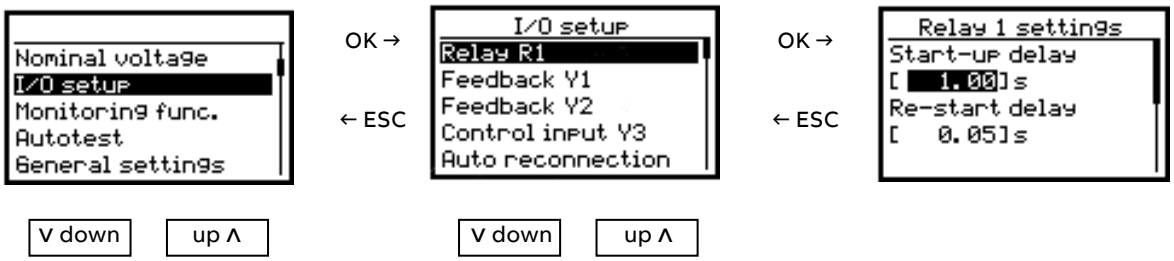
Menu navigation

- If the display is dark, press any button to light it up
- Press OK button to enter the menu
- Press arrow buttons to move between functions and parameters
- Press OK button to enter the chosen page
- Press arrow buttons to modify the values of the parameters
- Press OK button to confirm the value and proceed
- Press ESC button to return to the previous menu
- Press arrow buttons more than 1 s to scroll through the menu or password menu

Changes of parameters can be cancelled by pressing the ESC button.

Menu structure

Main menu **Submenu**



					VDE-AR-N 4105:2018-11		
Menu			**Configuration possibilities**	**Step size**	**Inverter (default)**	**Pn > 50Kw**	**Pn < 50Kw**
Nominal voltage	Measuring principle		[3L-N + 3L-L], [3L-N], [3L-L], [1L-N]		3L-N + 3L-L	3L-N + 3L-L	3L-N + 3L-L
	Nominal voltage		[57.7]-[230.9] V L-N / [99.9]-[400.0] V L-L	0.1 V	230 V L-N / 398.4 V L-L	230 V L-N / 398.4 V L-L	230 V L-N / 398.4 V L-L
I/O setup	Relay R3	Working principle	[disabled], [open-circuit], [closed-circuit], [sync. with R1/R2], [bus controlled]*, [bus fault]*		disabled	disabled	disabled
		ON-delay	[0.00]-[10.00] s	0.01 s	0 s	0 s	0 s
		ON-time	[0.05]-[10.00] s	0.01 s	0.5 s	0.5 s	0.5 s
	Feedback Y1	Monitoring	[disabled], [enabled], [tripping only]		enabled	enabled	enabled
		Working principle	[normally closed], [normally open], [auto detection]		auto detection	auto detection	auto detection
		Trip window	[0.05]-[0.50] s	0.01 s	0.1 s	0.1 s	0.1 s
		Release window	[0.5]-[6000.0] s	0.1 s	0.5 s	0.5 s	0.5 s
	Feedback Y2	Monitoring	[disabled], [enabled], [tripping only]		enabled	enabled	enabled
		Working principle	[normally closed], [normally open], [auto detection]		auto detection	auto detection	auto detection
		Trip window	[0.05]-[0.50] s	0.01 s	0.1 s	0.1 s	0.1 s
		Release window	[0.5]-[6000.0] s	0.1 s	0.5 s	0.5 s	0.5 s
	Control Input Y3	Function	[disabled], [remote trip], [suppress Y1], [suppress Y2], [suppress Y1/Y2], [suppress VS]		disabled	disabled	disabled
		Working principle	[normally closed], [normally open]		normally open	normally open	normally open
	Auto reconnection	Number of attempts	[0]-[3]	1	0	0	0
Monitoring functions	Overvoltage >UAV	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[0.100]-[1.300] xU_n	0.005 xU_n	1.1 xU_n	1.1 xU_n	1.1 xU_n
		Hysteresis	[0.1]-[10.0] %	0.1 %	0.1 %	0.1 %	0.1 %
	Overvoltage >U1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[0.100]-[1.300] xU_n	0.005 xU_n	1.25 xU_n	1.25 xU_n	1.15 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1 %	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Overvoltage >U2	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[0.100]-[1.300] xU_n	0.005 xU_n	1.15 xU_n	1.15 xU_n	1.15 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1 %	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s

* For CM-UFD.M31M only

					VDE-AR-N 4105:2018-11		
Menu			**Configuration possibilities**	**Step size**	**Inverter (default)**	**Pn > 50Kw**	**Pn < 50Kw**
Monitoring functions	Undervoltage <U1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[0.100]-[1.300] xU_n	0,005 xU_n	0.8 xU_n	0.8 xU_n	0.8 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1%	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	3.0 s	1.0 s	0.1 s
	Undervoltage <U2	Monitoring	[disabled], [enabled]		enabled	enabled	disabled
		Threshold value	[0.100]-[1.300] xU_n	0,005 xU_n	0.45 xU_n	0.45 xU_n	0.8 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1%	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.3 s	0.3 s	0.1 s
	Overfrequency >F1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	51.5 Hz	51.5 Hz	51.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Overfrequency >F2	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	51.5 Hz	51.5 Hz	51.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Underfrequency <F1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	47.5 Hz	47.5 Hz	47.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Underfrequency <F2	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	47.5 Hz	47.5 Hz	47.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	ROCOF	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[0.100]-[5.000] Hz/s	0.005 Hz/s	1 Hz/s	1 Hz/s	1 Hz/s
		Number of cycles	[4]-[50]	1	50	50	50
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
		Error time	[0.50]-[600.00] s	0.01 s	30 s	30 s	30 s
	Vector Shift VS	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[2.0]-[40.0] °	0.1 °	10 °	10 °	10 °
		Error time	[0.50]-[600.00] s	0.01 s	30 s	30 s	30 s
Switch-on conditions	Switch-on delay	Switch-on delay	[1.0]-[6000.0] s	0.1 s	60 s	60 s	60 s
		Short interruption	[disabled], [enabled]		enabled	enabled	enabled
	Voltage window	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Minimum	[0.100]-[1.000] xU_n	0,005 xU_n	0.85 xU_n	0.85 xU_n	0.85 xU_n
		Maximum	[1.000]-[1.300] xU_n	0.005 xU_n	1.1 xU_n	1.1 xU_n	1.1 xU_n
	Frequency window	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Minimum	[45.00]-[60.00] Hz	0.01 Hz	47.5	47.5	47.5
		Maximum	[50.00]-[65.00] Hz	0.01 Hz	50.10	50.10	50.10
General settings	Language	Language	[English], [Deutsch],[Polski]		Deutsch *)	Deutsch *)	Deutsch *)
	Display	Switch-off delay	[10]-[600]s	1 s	10 s *)	10 s *)	10 s *)
		Contrast	[0]-[9]	1	5 *)	5 *)	5 *)
	Plant Operator Password	Protection	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Change password	[****]		0000 *)	0000 *)	0000 *)
	Grid Operator Password	Protection	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Change password	[****]		0000 *)	0000 *)	0000 *)

					VDE-AR-N 4105:2018-11		
Menu			**Configuration possibilities**	**Step size**	**Inverter (default)**	**Pn > 50Kw**	**Pn < 50Kw**
General settings	Load settings	„Setting name“					
	Save settings	„Setting name“					
	Information						
Modbus*	Bus mode	Communication	[disabled], [enabled]		disabled *)	disabled *)	disabled *)
		Remote trip via bus	[disabled], [enabled]		disabled *)	disabled *)	disabled *)
		Fault reaction	[trip R1/R2, fault message]		fault message *)	fault message *)	fault message *)
		Timeout	1-600 s	1 s	10 s *)	10 s *)	10 s *)
	Bus configuration	Slave address	1-247	1	1 *)	1 *)	1 *)
		Baud rate	[1200], [2400], [4800], [9600], [19200], [38400], [57600], [115200]		19200 *)	19200 *)	19200 *)
		Parity	[EVEN, ODD, NONE]		EVEN *)	EVEN *)	EVEN *)
Error memory	Error list						
	Error recording	Remote trip via Y3	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Remote trip via bus	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Power OFF	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
	Reset error memory						
	Operating counter						
	Cumulated OFF-time						
	Trip counter						

*) Device defaults, not affected by loading a setting

* For CM-UFD.M31M only

Menu			**Configuration possibilities**	**Step size**	**VDE-AR-N 4105:2011**	**VDE-AR-N 4110:2018-11**	**VDE-AR-N 4120:2018-11**
Nominal voltage	Measuring principle		[3L-N + 3L-L], [3L-N], [3L-L], [1L-N]		3L-N + 3L-L	3L-N	3L-N
	Nominal voltage		[57.7]-[230.9] V L-N / [99.9]-[400.0] V L-L	0.1 V	230 V L-N / 398.4 V L-L	230 V L-N	230 V L-N
I/O setup	Relay R3	Working principle	[disabled], [open-circuit], [closed-circuit], [sync. with R1/R2], [bus controlled]*, [bus fault]*		disabled	disabled	disabled
		ON-delay	[0.00]-[10.00] s	0.01 s	0 s	0 s	0 s
		ON-time	[0.05]-[10.00] s	0.01 s	0.5 s	0.5 s	0.5 s
	Feedback Y1	Monitoring	[disabled], [enabled], [tripping only]		enabled	disabled	disabled
		Working principle	[normally closed], [normally open], [auto detection]		normally closed	auto detection	auto detection
		Trip window	[0.05]-[0.50] s	0.01 s	0.1 s	0.1 s	0.1 s
		Release window	[0.5]-[6000.0] s	0.1 s	0.5 s	0.5 s	0.5 s
	Feedback Y2	Monitoring	[disabled], [enabled], [tripping only]		enabled	disabled	disabled
		Working principle	[normally closed], [normally open], [auto detection]		auto detection	auto detection	auto detection
		Trip window	[0.05]-[0.50] s	0.01 s	0.1 s	0.1 s	0.1 s
		Release window	[0.5]-[6000.0] s	0.1 s	0.5 s	0.5 s	0.5 s
	Control Input Y3	Function	[disabled], [remote trip], [suppress Y1], [suppress Y2], [suppress Y1/Y2], [suppress VS]		disabled	disabled	disabled
		Working principle	[normally closed], [normally open]		normally open	normally open	normally open

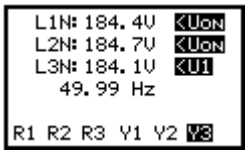
Menu			Configuration possibilities	Step size	VDE-AR-N 4105:2011	VDE-AR-N 110:2018-11	VDE-AR-N 4120:2018-11
I/O setup	Auto reconnection	Number of attempts	[0]-[3]	1	0	0	not mentioned/0
Monitoring functions	Overvoltage >UAV	Monitoring	[disabled], [enabled]		enabled	disabled	disabled
		Threshold value	[0.100]-[1.300] xU_n	0.005 xU_n	1.1 xU_n	1.1 xU_n	1.1 xU_n
		Hysteresis	[0.1]-[10.0] %	0.1 %	0.1 %	0.1 %	0.1 %
	Overvoltage >U1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[0.100]-[1.300] xU_n	0.005 xU_n	1.15 xU_n	1.25 xU_n	1.25 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1 %	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.5 s
	Overvoltage >U2	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[0.100]-[1.300] xU_n	0.005 xU_n	1.15 xU_n	1.2 xU_n	1.2 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1 %	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Undervoltage <U1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[0.100]-[1.300] xU_n	0,005 xU_n	0.8 xU_n	0.8 xU_n	0.8 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1%	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	2.4 s	1.5 s to 2.4 s
	Undervoltage <U2	Monitoring	[disabled], [enabled]		disabled	enabled	enabled
		Threshold value	[0.100]-[1.300] xU_n	0,005 xU_n	0.8 xU_n	0.3 xU_n	0.3 xU_n
		Hysteresis	[0.5]-[10.0] %	0.1%	1 %	1 %	1 %
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.8 s	0.8 s
	Overfrequency >F1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	51.5 Hz	51.5 Hz	51.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	5 s	5 s
	Overfrequency >F2	Monitoring	[disabled], [enabled]		disabled	enabled	enabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	51.5 Hz	52.5 Hz	52.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Underfrequency <F1	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	47.5 Hz	47.5 Hz	47.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	Underfrequency <F2	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[45.00]-[65.00] Hz	0.01 Hz	47.5 Hz	47.5 Hz	47.5 Hz
		Hysteresis	[0.05]-[4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
	ROCOF	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[0.100]-[5.000] Hz/s	0.005 Hz/s	1 Hz/s	1 Hz/s	1 Hz/s
		Number of cycles	[4]-[50]	1	50	50	50
		Tripping delay	[0.06]-[600.00] s	0.01 s	0.1 s	0.1 s	0.1 s
		Error time	[0.50]-[600.00] s	0.01 s	30 s	30 s	30 s
	Vector Shift VS	Monitoring	[disabled], [enabled]		disabled	disabled	disabled
		Threshold value	[2.0]-[40.0] °	0.1 °	10 °	10 °	10 °
		Error time	[0.50]-[600.00] s	0.01 s	30 s	30 s	30 s
Switch-on conditions	Switch-on delay	Switch-on delay	[1.0]-[6000.0] s	0.1 s	60 s	600 s	600 s
		Short interruption	[disabled], [enabled]		enabled	enabled	enabled

Menu			Configuration possibilities	Step size	VDE-AR-N 4105:2011	VDE-AR-N 110:2018-11	VDE-AR-N 4120:2018-11
	Voltage window	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Minimum	[0.100]-[1.000] xU_n	0,005 xU_n	0.85 xU_n	0.95 xU_n	0.9 xU_n
		Maximum	[1.000]-[1.300] xU_n	0.005 xU_n	1.1 xU_n	1.1 xU_n	1.1 xU_n
	Frequency window	Monitoring	[disabled], [enabled]		enabled	enabled	enabled
		Minimum	[45.00]-[60.00] Hz	0.01 Hz	47.5	49.9	47.5
		Maximum	[50.00]-[65.00] Hz	0.01 Hz	50.05	50.10	51.5
General settings	Language	Language	[English], [Deutsch], [Polski]		Deutsch *)	Deutsch *)	Deutsch *)
	Display	Switch-off delay	[10]-[600]s	1 s	10 s *)	11 s *)	10 s *)
		Contrast	[0]-[9]	1	5 *)	6 *)	5 *)
	Plant Operator Password	Protection	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Change password	[****]		0000 *)	1 *)	0000 *)
	Grid Operator Password	Protection	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Change password	[****]		0000 *)	1 *)	0000 *)
	Load settings	„Setting name“					
	Save settings	„Setting name“					
	Information						
Modbus*	Bus mode	Communication	[disabled], [enabled]		disabled *)	disabled *)	disabled *)
		Remote trip via bus	[disabled], [enabled]		disabled *)	disabled *)	disabled *)
		Fault reaction	[trip R1/R2, fault message]		fault message *)	fault message *)	fault message *)
		Timeout	1-600 s	1 s	10 s *)	11 s *)	10 s *)
	Bus configuration	Slave address	1-247	1	1 *)	1 *)	1 *)
		Baud rate	[1200], [2400], [4800], [9600], [19200], [38400], [57600], [115200]		19200 *)	19200 *)	19200 *)
		Parity	[EVEN, ODD, NONE]		EVEN *)	EVEN *)	EVEN *)
Error memory	Error list						
	Error recording	Remote trip via Y3	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Remote trip via bus	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
		Power OFF	[disabled], [enabled]		enabled *)	enabled *)	enabled *)
	Reset error memory						
	Operating counter						
	Cumulated OFF-time						
	Trip counter						

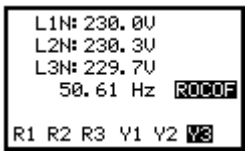
*) Device defaults, not affected by loading a setting

* For CM-UFD.M31M only

Display and failure messages

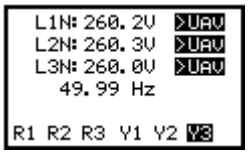


The voltage at L3 has fallen below the first undervoltage threshold. The voltages at L1 and L2 have fallen below the switch-on conditions, yet not below the undervoltage threshold.

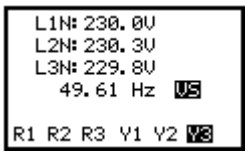


Error, ROCOF

Threshold for rate of change of frequency exceeded.

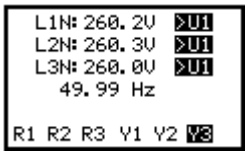


Error overvoltage U_{AV} in all three phases detected. If overvoltage occurs in one phase only, $>U_{AV}$ indicates the phase with overvoltage.

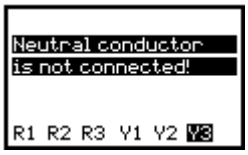


Error, vector shift

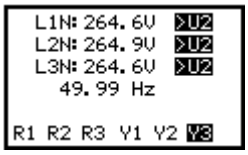
Threshold for vector shift exceeded.



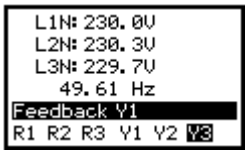
Error overvoltage >U1 in all three phases detected. If overvoltage occurs in one phase only, >U1 indicates the phase with overvoltage.



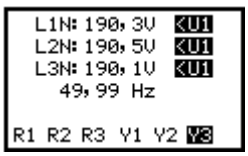
4-wire connection
The neutral conductor is disconnected or interrupted.
Please check wiring.



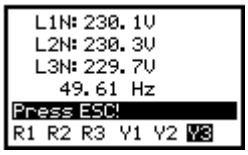
Error overvoltage >U2 in all three phases detected. If overvoltage occurs in one phase only, >U2 indicates the phase with overvoltage.



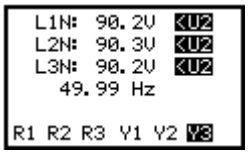
Error in feedback loop Y1-Y0, e.g. wiring failure or welded feedback contact.
Please check wiring.



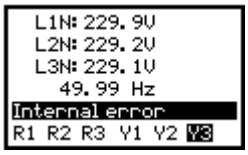
Error undervoltage <U1 in all three phases detected. If undervoltage occurs in one phase only, <U1 indicates the phase with undervoltage.



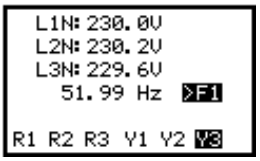
Error in feedback loop is removed. Press ESC to reset the grid feeding monitoring relay.



Error undervoltage <U2 in all three phases detected. If undervoltage occurs in one phase only, <U2 indicates the phase with undervoltage.

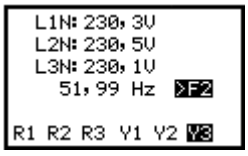


Failure within the logic or hardware of the device. Remove supply and restart. If failure still occurs, there is a permanent failure in the device.

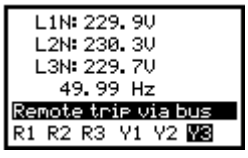


Error overfrequency >F1 detected

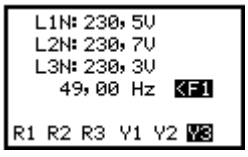
Remote trip via Y3
Shows that the remote trip is activated via control input Y3



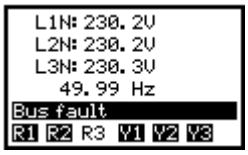
Error overfrequency >F2 detected



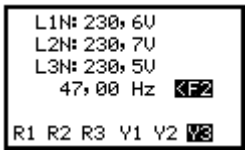
Remote trip via Bus*
Shows that the remote trip is achieved via Bus and output relay R1 is de-energized.



Error underfrequency <F1 detected



Error Bus fault*
Device has detected a bus fault, e.g a cyclic bus master is missing.

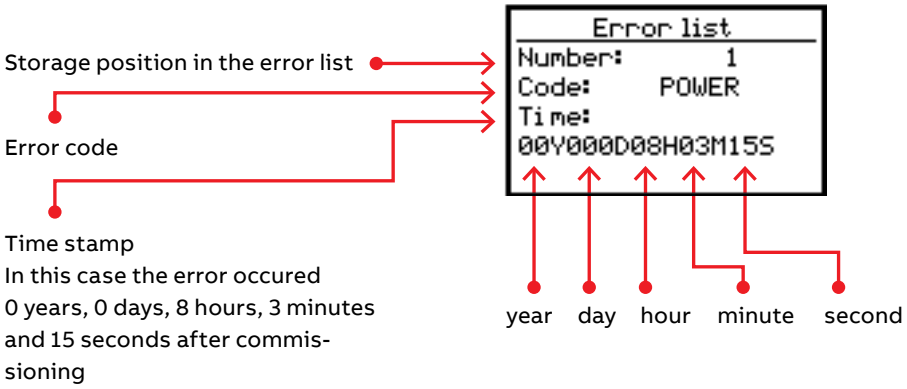


Error underfrequency <F2 detected

* For CM-UFD.M31M only

Error memory

As soon as one of the above errors occurs, subsequent error codes with the corresponding time stamp will be stored in the error memory:

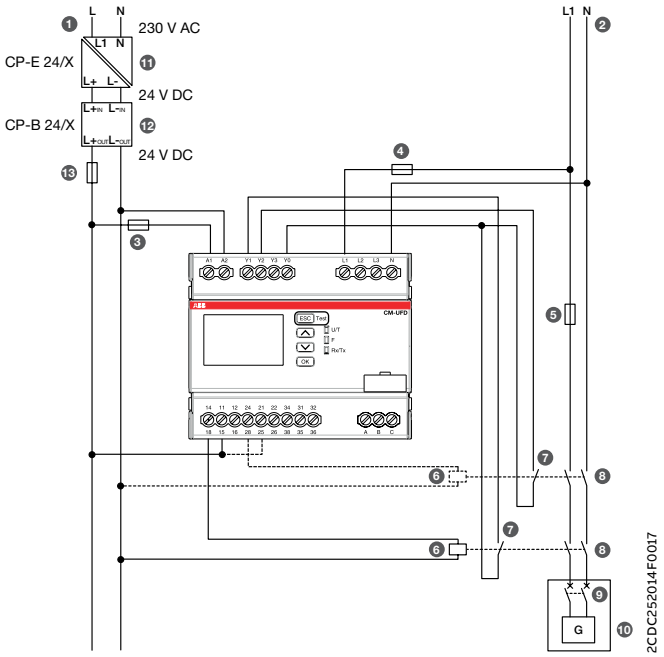


Error code	Explanation	
AVL1N>U_{AV} or AVL2N>U_{AV} or AVL3N>U_{AV}	Error, overvoltage U_{AV}	10-minutes average value
AVL12>U_{AV} or AVL23>U_{AV} or AVL31>U_{AV}	Error, overvoltage U_{AV}	10-minutes average value
L1N<U1 or L2N<U1 or L3N<U1	Error, overvoltage U1	
L12>U1 or L23>U1 or L31>U1	Error, overvoltage U1	
L1N>U2 or L2N>U2 or L3N>U2	Error, overvoltage U2	
L12>U2 or L23>U2 or L31>U2	Error, overvoltage U2	
L1N<U1 or L2N<U1 or L3N<U1	Error, undervoltage U1	
L12<U1 or L23<U1 or L31<U1	Error, undervoltage U1	
L1N<U2 or L2N<U2 or L3N<U2	Error, undervoltage U2	
L12<U2 or L23<U2 or L31<U2	Error, undervoltage U2	
F>F1	Error, overfrequency F1	
F>F2	Error, overfrequency F2	
F<F1	Error, underfrequency F1	
F<F2	Error, underfrequency F2	
ROCOF	Error, ROCOF	
VECTOR	Error, Vector shift	
TEST	Error, test function	
REMOTE Y3	Error, remote trip via control input Y3	
REMOTE BUS*	Error, remote trip via Bus	
BUS FAULT*	Error, Bus fault	CM-UFD.M31M has detected a bus fault (e.g. cyclic bus master is missing)
FB1	Error, feedback of switching device 1	Malfunction of the first switching device
FB2	Error, feedback of switching device 2	Malfunction of the second switching device
POWER	Error, power	Supply voltage is disconnected or too low
NEUTRAL	Error, interrupted neutral detection	
Exxx (e.g. E123)	Internal error	Failure within the logic or hardware of the device

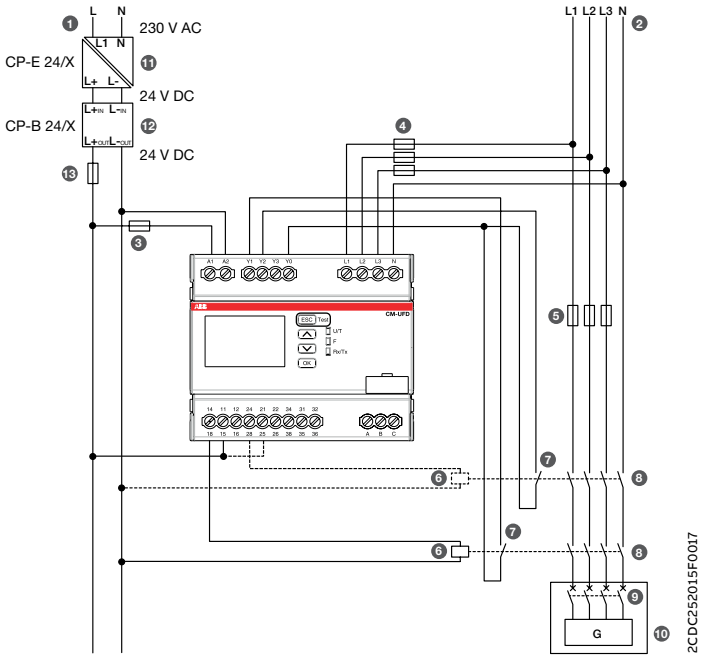
* For CM-UFD.M31M only

Connection and wiring

Example of single-phase application



Example of three-phase application



Legend

1. Control supply voltage for CM-UFD.M31(M)
2. Public grid
3. Protection fuse for the CM-UFD.M31(M)
4. Protection fuse for the measuring circuit of the CM-UFD.M31(M) (optional)
5. Short-circuit protection
6. Undervoltage release
7. Control input for feedback function
8. Switching device of the section switch
9. Switching device of the generator and/or inverter
10. Generator and/or inverter
11. Primary switch mode power supply unit CP-E (230 V AC / 24 V DC) for the buffer module CP-B
12. Ultra-capacitor based buffer module CP-B (24 V DC in/out)
13. Wire protection fuse for the output of the buffer module CP-B

Technical data

Data at T_a = 25 °C and rated values, unless otherwise indicated

Input circuits*

Supply circuit		**A1-A2**
Rated control supply voltage U_s		24-240 V AC/DC
Rated control supply voltage U_s tolerance		-15...+10 %
Rated frequency		DC or 50/60 Hz
Frequency range AC		40-70 Hz
Typical current / power consumption	24 V DC	60 mA / 1.4 W
	230 V AC	22 mA / 5.0 VA
Power failure buffering time		200 ms, acc. LVFRT (110-240 V AC)
		10 ms, acc. IEC/EN 60255-26 (24 V AC/DC)
		1000 ms (230 V AC, 24°C - typical value)

Measuring circuits		**L1, L2, L3, N**
Nominal voltage of the distribution system U_n		57.7-230.9 V AC / 99.9-400.0 V AC
Measuring ranges	voltage: line to neutral	0-312 V AC
	voltage: line to line	0-540 V AC
	frequency	40-70 Hz
Accuracy within the temperature range	voltage	≤ 0,5 % ± 0,5 V
	frequency	± 20 mHz
	delay times	≤ 0,1 % ± 20 ms (unless otherwise specified)
Monitoring functions	overvoltage 10-min average (>U_{AV})	threshold adjustable, 0.100-1.300 x U_n in 0.005 x U_n steps
	overvoltage (>U1)	
	overvoltage (>U2)	
	undervoltage (<U1)	threshold adjustable, 0.100-1.300 x U_n in 0.005 x U_n steps
	undervoltage (<U2)	
	overfrequency (>F1)	threshold adjustable, 45.00-65.00 Hz in 0.01 Hz steps
	overfrequency (>F2)	
	underfrequency (<F1)	threshold adjustable, 45.00-65.00 Hz in 0.01 Hz steps
	underfrequency (<F2)	
	ROCOF	threshold adjustable, 0.1-5 Hz/s in 0.005 Hz/s steps
	vector shift	threshold adjustable, 2.0-40.0 °, in 0.1 ° steps
Hysteresis related to the threshold values	overvoltage 10-min average (>U_{AV})	adjustable, 0.1-10.0 % in 0.1 % steps
	overvoltage (>U1, >U2)	adjustable, 0.5-10.0 % in 0.1 % steps
	undervoltage (<U1, <U2)	
	overfrequency (>F1, >F2)	adjustable, 0.05-4.00 Hz in 0.01 Hz steps
	underfrequency (<F1, <F2)	
Measuring method		true RMS
Measuring cycle	ROCOF	adjustable between 4 and 50 periods

Control circuits		**Y0, Y1, Y2, Y3**
Number of control inputs		3
Type of triggering		volt-free triggering, signal source Y0
Control function	Y1-Y0 control input 1	feedback switching device 1
	Y2-Y0 control input 2	feedback switching device 2
	Y3-Y0 control input 3	remote trip, suppression of Y1, Y2, Y1/Y2 or suppression of vector shift detection
Electrical isolation	from the supply voltage	yes
	from the measuring circuit	no
	from the relay outputs	yes
	from the communication interface*"	yes
Maximum switching current in the control circuit		6 mA
No-load voltage at the control inputs		typ. 24 V DC
Minimum control pulse length		20 ms
Maximum cable length at the control inputs		10 m

*Voltage transformers may be used in low voltage applications to transform and adapt the measuring input to ensure the voltage magnitude applied to the input terminals fall within the beforementioned voltage range. This to allow for the effective application of the Under-/Overvoltage and Under-/Overfrequency monitoring functions.
**For CM-UFD.M31M only

Timing functions

Switch-on delay (prior to first grid connection or re-connection after interruption)		adjustable, 1.00-6000.00 s in 0.01 s steps
ON-delay R3		adjustable, 0.00-10.00 s in 0.01 s steps
ON-time R3		adjustable, 0.05-10.00 s in 0.01 s steps
Trip window, feedback loop		adjustable, 0.05-0.50 s in 0.01 s steps
Release window, feedback loop		adjustable, 0.5-6000.0 s in 0.1 s steps
Tripping delay	overvoltage	adjustable, 0.06-600.00 s in 0.01 s steps; + 0 / - 50 ms
	undervoltage	
	overfrequency	
	underfrequency	
	ROCOF	
Error time	ROCOF	adjustable, 0.5-600.00 s in 0.01 s steps
	vector shift	
Reaction time	overvoltage av.	max. 3 s
	vector shift	< 50 ms
	interrupted neutral conductor	< 150 ms

User interface

Indication of operational states		
Control supply voltage applied / timing	U/T	LED green on / flashing
Fault message	F	LED red on
Modbus frame reception and transmission*	Rx/Tx	LED yellow flashing
For details see the message on the display		

Display		
Backlight	on	press any button
	off	switch-off delay adjustable, 10-600 s (default 10 s)
Resolution		112 x 64 pixel
Display size		36 x 22 mm

Operating controls
4 push-buttons for menu navigation, setting and entering

* For CM-UFD.M31M only

Communication interface*

Supported communication protocol	Modbus RTU
Physical interface	3-wire RS-485
Integrated termination resistors	no
Possible bus addresses	1-247
Baud rates	1.2 / 2.4 / 4.8 / 9.6 /19.2 / 38.4 / 57.6 / 115.2 kBit/s
Typical response time	< 10 ms
Timeout	1-600 s (default 10 s)
RS-485 unit load	¼ unit load (max. 128 devices)

* For CM-UFD.M31M only

Output circuits

Kind of outputs	11-12/14 (15-16/18)	relay R1, c/o (SPDT) contact, tripping relay for switching device 1
	21-22/24 (25-26/28)	relay R2, c/o (SPDT) contact, tripping relay for switching device 2
	31-32/34 (35-36/38)	relay R3, c/o (SPDT) contact, configurable
Operating principle	11-12/14	closed-circuit principle*
	21-22/24	closed-circuit principle*
	31-32/34	configurable (disabled, open-circuit, closed-circuit, sync. with R1/2, bus-controlled, bus fault)*
Contact material		AgNi alloy, Cd-free
Minimum switching voltage / minimum switching current		24 V / 10 mA
Maximum switching voltage / maximum switching current		see "Load limit curves"
Rated operational voltage U_e and rated operational current I_e	AC-12 (resistive) at 230 V	4 A
	AC-15 (inductive) at 230 V	3 A
	DC-12 (resistive) at 24 V	4 A
	DC-13 (inductive) at 24 V	2 A

Mechanical lifetime		30 x 10^6 switching cycles
Electrical lifetime	at AC-12, 230 V AC, 4 A	0.1 x 10^6 switching cycles
Maximum fuse rating to achieve short-circuit protection	n/c contact	10 A fast-acting
	n/o contact	10 A fast-acting
Conventional thermal current I_{th}		5 A

* Closed-circuit principle: Output relay de-energizes if a fault is occuring
Open-circuit principle: Output relay energizes if a fault is occuring

General data

MTBF		on request
Duty cycle		100 %
Dimensions		see "Dimensional drawing"
Weight	net	0.312 kg (0.687 lb)
Mounting		DIN rail (IEC/EN 60715) TH 35-7.5 and TH 35-15, snap-on mounting without any tool
Mounting position		any
Minimum distance to other units	horizontal / vertical	not necessary
Degree of protection	housing / terminals	IP20

Electrical connection

Connecting capacity	fine-strand with wire end ferrule	1 x 0.25-4 mm² (1 x 24-12 AWG) 2 x 0.25-0.75 mm² (2 x 24-18 AWG)
	fine-strand without wire end ferrule	1 x 0.2-4 mm² (1 x 24-12 AWG) 2 x 0.2-1.5 mm² (2 x 24-16 AWG)
	rigid	1 x 0.2-6 mm² (1 x 24-10 AWG) 2 x 0.2-1.5 mm² (2 x 24-16 AWG)
Stripping length		8 mm (0.31 in)
Tightening torque		0.5-0.6 Nm (4.4-5.3 lb.in)
Recommended screw driver		PH1 / Ø 4.0 mm

Environmental data

Ambient temperature ranges	operation	-20 °C...+60 °C (-4...+140 °F)
	storage	-20 °C...+80 °C (-4...+176 °F)
Damp heat, cyclic	IEC/EN 60068-2-30	6 x 24 h cycle, 55 °C, 95 % RH
Climatic class	IEC/EN 60721-3-3	3K5 (no condensation, no ice formation)
Vibration, sinusoidal		class 2
Shock		class 2

Isolation data

Rated insulation voltage U_i, overvoltage category		
basic insulation	measuring (L1/L2/L3/N)	300 V, IV 600 V, III
	output 1 / output 2 / output 3	300 V, III
reinforced/doubled insulation	supply / control inputs / outputs / com.interface*	300 V, III
	measuring (L1/L2/L3/N) / (supply / outputs / com.interface*)	300 V, IV
Rated impulse withstand voltage U_{imp}	output 1 / output 2 / output 3	4 kV; 1.2/50 µs
	supply / control inputs / outputs / com.interface*	6 kV; 1.2/50 µs
	measuring (L1/L2/L3/N) / (supply / outputs / com.interface*)	8 kV; 1.2/50 µs
Pollution degree		3

* For CM-UFD.M31M only

Standards/Directives

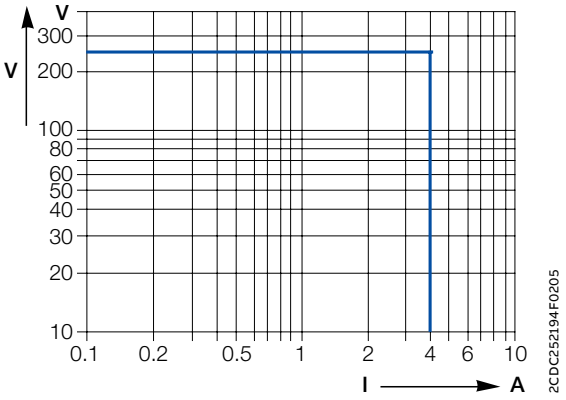
Standards	IEC/EN 60255-1, IEC/EN 60255-26, IEC/EN 60255-27, VDE-AR-N 4105, VDE-AR-N 4110, VDE-AR-N 4120
Low Voltage Directive	2014/35/EU
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU

Electromagnetic compatibility

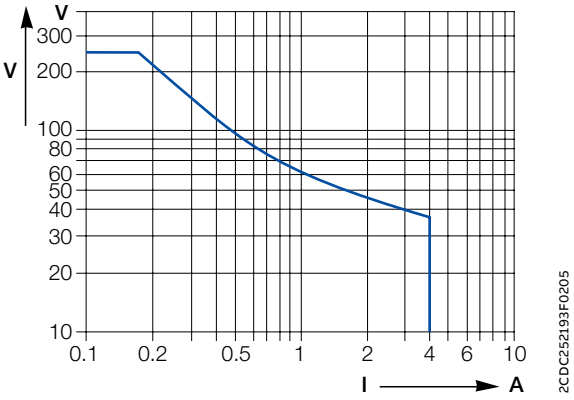
Interference immunity to		IEC/EN 60255-26
electrostatic discharge	IEC/EN 61000-4-2	level 3, 6 kV contact discharge, 8 kV air discharge
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	level 3, 10 V/m; 2.7 GHz
electrical fast transient / burst	IEC/EN 61000-4-4	zone B / level 3, 2 kV / 5 kHz
surge	IEC/EN 61000-4-5	supply circuit and measuring circuit zone B / level 3; 1 kV L-L
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	level 3, 10 V
voltage dips, short interruptions and voltage variations	IEC/EN 61000-4-11	class 3
Interference emission		IEC/EN 61000-6-3
high-frequency radiated		fulfilled
high-frequency conducted		fulfilled

Technical diagrams

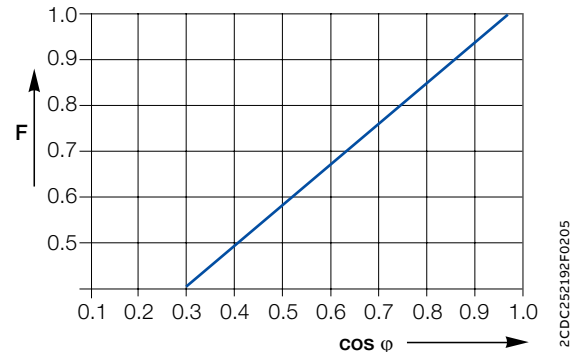
Load limits curves



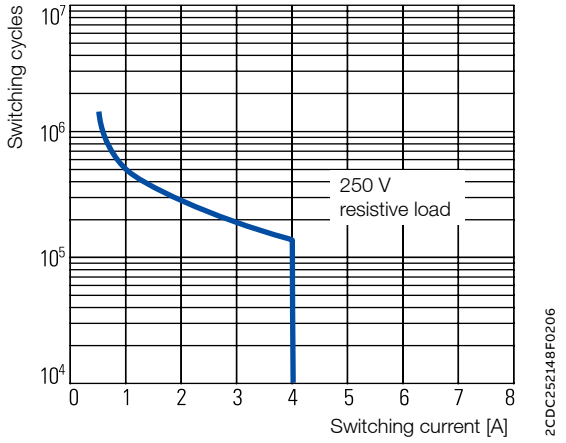
AC load (resistive)



DC load (resistive)



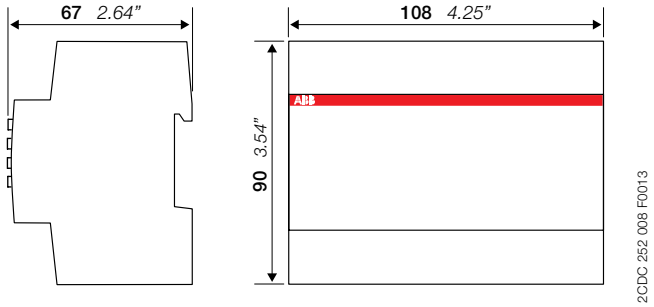
Derating factor F at inductive AC load



Contact lifetime

Dimensional drawings

in mm and inches



Further documentation

Document title	Document type	Document number
CM-UFD.M31M Grid feeding monitoring relay	Instruction	1SVC 560 515 M0000
How to integrate the grid feeding monitoring relay CM-UFD into ABB Ability	Application note	2CDC 112 278 D0201

You can find the documentation on the internet at www.abb.com/lowvoltage
-> Automation, control and protection -> Electronic relays and controls -> Measuring and monitoring relays.

CAD system files

You can find the CAD files for CAD systems at http://abb-control-products.partcommunity.com
-> Low Voltage Products & Systems -> Control Products -> Electronic Relays and Controls.

Cyber security

Legal disclaimer

The CM-UFD.MxxM is designed to be connected in the ABB and 3rd party products and communicate information data via network interface. It is the user's sole responsibility to provide and continuously ensure a secure connection between the product and the user's network or any other. The user shall establish and maintain any appropriate measures (such as but not limited to the installation of fire-walls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system, and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unau-thorized access, interference, intrusion, leakage and/or theft of data or information. The data, exam-ples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties. All people responsible for applying the equip-ment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. Any risks in applications where a system failure and/or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsi-bility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks. This document has been carefully checked by ABB, but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commit-ments, in no event shall ABB be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.

Enhancing network security

The implementation of the following measures is highly recommended in order to enhance the security of networks:

1. Network Isolation – separate the OT network (operation technology) from the IT network (information technology). This helps prevent any attack reaching the IT network from spread-ing to the OT network.
2. Use of firewalls – Implement firewalls to prevent unauthorized access to the OT network.
3. Use of access control – Implement access controls to restrict the human and device access to the OT network.
4. Keep software up to date – Make sure all software/firmware of the devices are up to date to have the latest security updates installed.
5. Reduce attack surface on devices – Disable device functions, services and ports not need-ed.
6. Replace default passwords – Replace all default passwords of the devices to prevent at-tacker from getting access using default credentials.
7. Monitor network activity – Monitor the OT network for any malicious activities that could be a sign of an attack. Example of network monitoring tool is intrusion detection system (IDS).
8. Train employees – Train operators and service people on IT and OT security best practices.
9. Train employees – Train operators and service people on IT and OT security best practices.

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