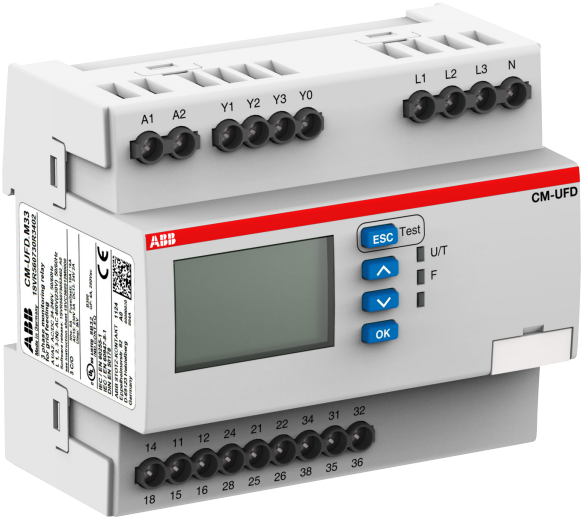
Data sheet

Grid feeding monitoring for generating plants connected to distribution systems CM-UFD.M33

The CM-UFD.M33 is a multifunctional grid feeding monitoring relay. It provides different monitoring functions 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. Additionaly, monitoring of ROCOF (rate of change of frequency) and vector shift can be configured.



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Characteristics

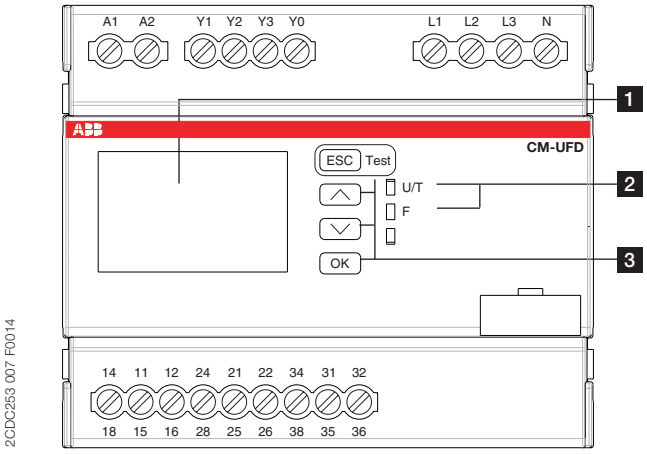
- Monitoring of voltage and frequency in single- and three-phase mains (2-wire, 3-wire or 4-wire AC systems)
- Pre-settings in accordance with G59/3 and G83/2
- Integrated management of redundancy function
- Multiline, backlit LCD display
- True RMS measuring principle
- Over- and undervoltage, 10-minutes 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
- Various certifications and approvals (see overview, document no. 2CDC112249D0201)

Order data

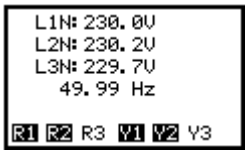
Type	Rated control supply voltage	Measuring range	Order code
CM-UFD.M33	24-240 V AC/DC	L-L: 0-550 V AC / L-N: 0-317 V AC	1SVR 560 730 R3402

Functions

Operating controls



1 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

2 Indication of operational states

U/T: green LED - Control supply voltage applied

Timing

F: red LED - Fault message

3 Keypad

ESC: escape / return to previous menu

∧: up / value increase

∨: down / value decrease

OK: enter / confirm selection

Application

The CM-UFD.M33 is a grid feeding monitoring relay, which is connected between the public grid and the distributed generation such as photovoltaic systems, wind turbines, block-type thermal power stations. It monitors the voltage and the frequency in the grid and disconnects the distributed generation whenever the measured values are not within the range of the adjusted thresholds. The fault is indicated by LED and the corresponding plain text message is shown on the display. The CM-UFD.M33 relay can be used in all low voltage plants and in medium voltage plants.

Operating mode

The CM-UFD.M33 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.

The CM-UFD.M33 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. 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.

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.

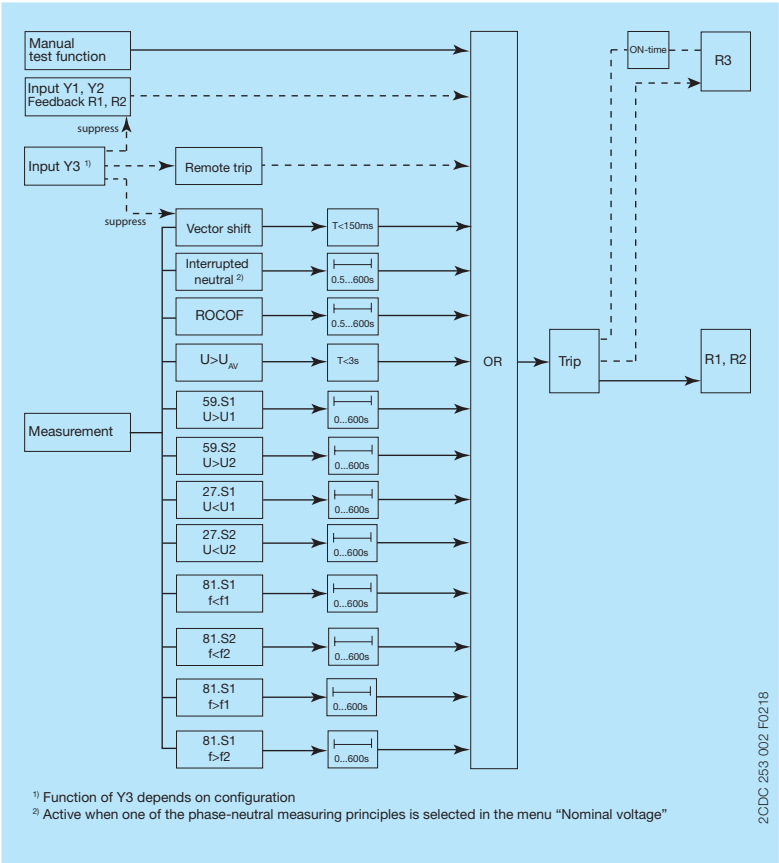
If a measured value exceeds or falls below the set threshold value (overvoltage, undervoltage, overfrequency or underfrequency), R1 and R2 de-energize after the adjusted tripping delay. As soon as the measured value returns to the tolerance range - taking into account an adjustable hysteresis – and all 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 energize, 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-energize.

Operating principle / Monitoring functions



Measurement algorithm:
The device samples the line voltages as input for the various protecive functions. The line frequency is based on the voltage zero crossing.

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 U_{AV} (10-minutes average value):
The CM-UFD.M33 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.

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.

The grid feeding standards vary from country to country. Some require that a section switch consists of 2 independent switching devices, while others require only 1 switching device working as section switch. In addition, not all standards require monitoring of the switching devices by the feedback monitoring. Therefore the monitoring functions of control inputs Y1-Y0 and Y2-Y0 are disabled by default. They can be manually enabled in the menu.

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.

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. 12 °. 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…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.

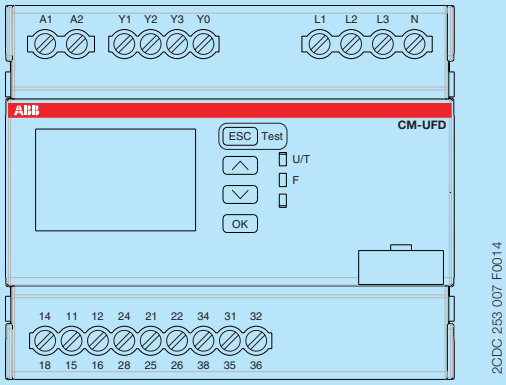
Error memory

The CM-UFD.M33 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.M33 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.

Electrical connection



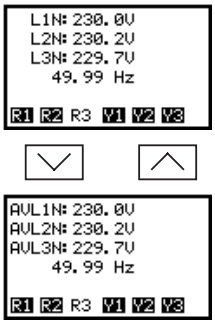
A1-A2	Control supply voltage
Y1-Y0	Control input 1, for feedback from switching device 1
Y2-Y0	Control input 2, for feedback from switching device 2
Y3-Y0	Control input 3, configurable
L1, L2, L3, N	Measuring input
11_{15}-12_{16}/14_{18}	Relay R1, c/o (SPDT) contact
21_{25}-22_{26}/24_{28}	Relay R2,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

Configuration

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.

Pre-settings

The CM-UFD.M33 is delivered with 2 sets of pre-settings according to EREC (Engineering Recommendation) G59/3 low voltage protection (same as G83/2) and G59/3 high voltage protection, which can be loaded in the submenu “General settings” -> “Load settings”.

Additionally, 5 sets of self-defined pre-settings can be saved in the memory and loaded by the user.

Password protection

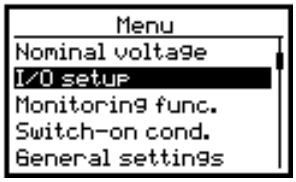
Every CM-UFD.M33 relay is delivered with the same default password [0000] for protection of its settings and local command. The installer is responsible for the verification of the parameter values and the change of the password with a personal one in order to avoid unwanted modifications.

Visualization of the parameters is always possible, modification only after having entered 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.

Menu structure

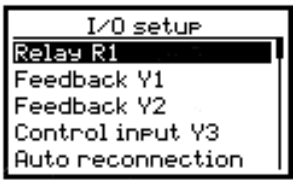
Main menu



OK →

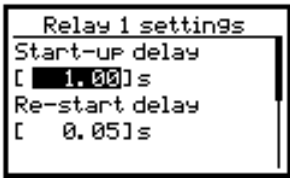
← ESC

Submenu



OK →

← ESC



∨ down up ∧ ∨ down up ∧

Main menu	Submenu	Options	Configuration possibilities	Step size	G59/3 LV + G83/2	G59/3 HV
Nominal voltage	Measuring principle		[3L-N + 3L-L], [3L-N], [3L-L], [1L-N]		3L-N	3L-L
	Nominal voltage		[57.7] - [240.0] V L-N / [99.9] - [415.7] V L-L	0.1 V	230 V L-N	110 V L-L
I/O setup	Relay 3	Working principle	[disabled], [open-circuit], [closed-circuit], [synchronous with R1/R2], [bus controlled], [bus fault]		disabled	disabled
		ON-delay	[0.00] - [10.00] s	0.01 s	0 s	0 s
		ON-time	[0.05] - [10.00] s	0.01 s	0.5 s	0.5 s
	Feedback Y1	Working principle	[normally closed], [normally open], [auto detection], [disabled]		disabled	disabled
		Trip window	[0.05] - [0.50] s	0.01 s	0.1 s	0.1 s
		Release window	[0.5] - [600.00] s	0.01 s	0.5 s	0.5 s
	Feedback Y2	Working principle	[normally closed], [normally open], [auto detection], [disabled]		disabled	disabled
		Trip window	[0.05] - [0.50] s	0.01 s	0.1 s	0.1 s
		Release window	[0.5] - [600.00] s	0.01 s	0.5 s	0.5 s
	Control input Y3	Function	[remote trip], [suppress Y1], [suppress Y2], [suppress Y1/Y2], [suppress VS]		remote trip	remote trip
		Working principle	[normally closed], [normally open], [disabled]		disabled	disabled
	Auto reconnection	Number of attempts	[0] - [3]	1	0	0
Monitoring function	Overvoltage >U_{AV}	Monitoring	[disabled], [enabled]		disabled	disabled
		Threshold value	[1.000] - [1.300] x U_n	0.005 x U_n	1.1 x U_n	1.1 x U_n
		Hysteresis	[0.1] - [10.0] %	0.1 %	0.1 %	0.1 %
	Overvoltage >U1	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[1.000] - [1.300] x U_n	0.005 x U_n	1.14 x U_n	1.1 x U_n
		Hysteresis	[0.5] - [10.0] %	0.1 %	1 %	1 %
		Tripping delay	[0.00] - [600.00] s	0.01 s	1 s	1 s
	Overvoltage >U2	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[1.000] - [1.300] x U_n	0.005 x U_n	1.19 x U_n	1.13 x U_n
		Hysteresis	[0.5] - [10.0] %	0.1 %	1 %	1 %
		Tripping delay	[0.00] - [600.00] s	0.01 s	0.5 s	0.5 s
	Undervoltage <U1	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[0.100] - [1.000] x U_n	0.005 x U_n	0.87 x U_n	0.87 x U_n
		Hysteresis	[0.5] - [10.0] %	0.1 %	1 %	1 %
		Tripping delay	[0.00] - [600.00] s	0.01 s	2.5 s	2.5 s
	Undervoltage <U2	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[0.100] - [1.000] x U_n	0.005 x U_n	0.8 x U_n	0.8 x U_n
		Hysteresis	[0.5] - [10.0] %	0.1 %	1 %	1 %
		Tripping delay	[0.00] - [600.00] s	0.01 s	0.5 s	0.5 s

Main menu	Submenu	Options	Configuration possibilities	Step size	G59/3 LV + G83/2	G59/3 HV
	Overfrequency >F1	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[50.00] - [65.00] Hz	0.01 Hz	51.50 Hz	51.50 Hz
		Hysteresis	[0.05] - [4.00] Hz	0.01 Hz	0.10 Hz	0.10 Hz
		Tripping delay	[0.00] - [600.00] s	0.01 s	90.00 s	90.00 s
	Overfrequency >F2	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[50.00] - [65.00] Hz	0.01 Hz	52.00 Hz	52.00 Hz
		Hysteresis	[0.05] - [4.00] Hz	0.01 Hz	0.10 Hz	0.10 Hz
		Tripping delay	[0.00] - [600.00] s	0.01 s	0.50 s	0.50 s
	Underfrequency <F1	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[45.00] - [60.00] Hz	0.01 Hz	47.50 Hz	47.50 Hz
		Hysteresis	[0.05] - [4.00] Hz	0.01 Hz	0.1 Hz	0.1 Hz
		Tripping delay	[0.00] - [600.00] s	0.01 s	20 s	20 s
	Underfrequency <F2	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[45.00] - [60.00] Hz	0.01 Hz	47.00 Hz	47.00 Hz
		Hysteresis	[0.05] - [4.00] Hz	0.01 Hz	0.10 Hz	0.10 Hz
		Tripping delay	[0.00] - [600.00] s	0.01 s	0.50 s	0.50 s
	ROCOF	Monitoring	[disabled], [enabled]		disabled	disabled
		Threshold value	[0.100] - [5.000] Hz/s	0.005 Hz/s	0.200 Hz/s	0.200 Hz/s
		Number of cycles	[4] - [50]	1	20	20
		Tripping delay	[0.00] - [600.00] s	0.01 s	0.10 s	0.10 s
		Error time	[0.50] - [600.00] s	0.01 s	1.00 s	1.00 s
	Vector Shift VS	Monitoring	[disabled], [enabled]		enabled	enabled
		Threshold value	[2.0] - [40.0] °	0.1 °	12.0 °	12.0 °
		Error time	[0.50] - [600.00] s	0.01 s	1.00 s	1.00 s
Switch-on conditions	Switch-on delay	Switch-on delay	[0.05] - [600.00] s	0.01 s	20 s	20 s
		Short interruption	[disabled], [enabled]		disabled	disabled
	Voltage window	Monitoring	[disabled], [enabled]		disabled	disabled
		Minimum	[0.100] - [1.000] x U_n	0.005 x U_n	0.900 x U_n	0.900 x U_n
		Maximum	[1.000] - [1.300] x U_n	0.005 x U_n	1.1 x U_n	1.1 x U_n
	Frequency window	Monitoring	[disabled], [enabled]		disabled	disabled
		Minimum	[45.00] - [60.00] Hz	0.01 Hz	49.00 Hz	49.00 Hz
		Maximum	[50.00] - [65.00] Hz	0.01 Hz	51.00 Hz	51.00 Hz
General settings	Local command	Local command	[disabled], [enabled]			
		Change LC password	[****]			
	Language	Language	[English], [Deutsch]			
	Display	Switch-off delay	[10] - [600] s	1 s		
		Contrast	[0] - [9]	1		
	Password	Protection	[disabled], [enabled]			
		Change password	[****]			
	Load settings	"Setting name"				
	Save settings	"Setting name"				
	Information					
Error memory	Error list					
	Error recording	Remote trip	[disabled], [enabled]			
		Power OFF	[disabled], [enabled]			
	Reset error memory					
	Operating counter					
	Cumulated OFF-time					

* Device default, not affected by loading a setting

Display and failure messages

```
L1N: 184.4V  <UON
L2N: 184.7V  <UON
L3N: 184.1V  <U1
  49.99 Hz
R1 R2 R3 Y1 Y2 Y3
```

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.

```
L1N: 260.2V  >UAV
L2N: 260.3V  >UAV
L3N: 260.0V  >UAV
  49.99 Hz
R1 R2 R3 Y1 Y2 Y3
```

Error overvoltage U_{AV} in all three phases detected.

If overvoltage occurs in one phase only, $>U_{AV}$ indicates the phase with overvoltage.

```
L1N: 260.2V  >U1
L2N: 260.3V  >U1
L3N: 260.0V  >U1
  49.99 Hz
R1 R2 R3 Y1 Y2 Y3
```

Error overvoltage >U1 in all three phases detected.

If overvoltage occurs in one phase only, >U1 indicates the phase with overvoltage.

```
L1N: 264.6V  >U2
L2N: 264.9V  >U2
L3N: 264.6V  >U2
  49.99 Hz
R1 R2 R3 Y1 Y2 Y3
```

Error overvoltage >U2 in all three phases detected.

If overvoltage occurs in one phase only, >U2 indicates the phase with overvoltage.

```
L1N: 190,3V  <U1
L2N: 190,5V  <U1
L3N: 190,1V  <U1
  49,99 Hz
R1 R2 R3 Y1 Y2 Y3
```

Error undervoltage <U1 in all three phases detected.

If undervoltage occurs in one phase only, <U1 indicates the phase with undervoltage.

```
L1N:  90.2V  <U2
L2N:  90.3V  <U2
L3N:  90.2V  <U2
  49.99 Hz
R1 R2 R3 Y1 Y2 Y3
```

Error undervoltage <U2 in all three phases detected.

If undervoltage occurs in one phase only, <U2 indicates the phase with undervoltage.

```
L1N: 230.0V
L2N: 230.2V
L3N: 229.6V
  51.99 Hz  >F1
R1 R2 R3 Y1 Y2 Y3
```

Error overfrequency >F1 detected

```
L1N: 230,3V
L2N: 230,5V
L3N: 230,1V
  51,99 Hz  >F2
R1 R2 R3 Y1 Y2 Y3
```

Error overfrequency >F2 detected

```
L1N: 230,5V
L2N: 230,7V
L3N: 230,3V
  49,00 Hz  <F1
R1 R2 R3 Y1 Y2 Y3
```

Error underfrequency <F1 detected

```
L1N: 230,6V
L2N: 230,7V
L3N: 230,5V
  47,00 Hz  <F2
R1 R2 R3 Y1 Y2 Y3
```

Error underfrequency <F2 detected

```
L1N: 230.0V
L2N: 230.3V
L3N: 229.7V
  50.61 Hz  ROCOF
R1 R2 R3 Y1 Y2 Y3
```

Error, ROCOF

Threshold for rate of change of frequency exceeded.

```
L1N: 230.0V
L2N: 230.3V
L3N: 229.8V
  49.61 Hz  VS
R1 R2 R3 Y1 Y2 Y3
```

Error, vector shift

Threshold for vector shift exceeded.

```
Neutral conductor
is not connected!
R1 R2 R3 Y1 Y2 Y3
```

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

Please check wiring.

```
L1N: 230.0V
L2N: 230.3V
L3N: 229.7V
  49.61 Hz
Feedback Y1
R1 R2 R3 Y1 Y2 Y3
```

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

Please check wiring.

```
L1N: 230.1V
L2N: 230.3V
L3N: 229.7V
  49.61 Hz
Press ESC!
R1 R2 R3 Y1 Y2 Y3
```

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

```
L1N: 229.9V
L2N: 229.2V
L3N: 229.1V
  49.99 Hz
Internal error
R1 R2 R3 Y1 Y2 Y3
```

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.

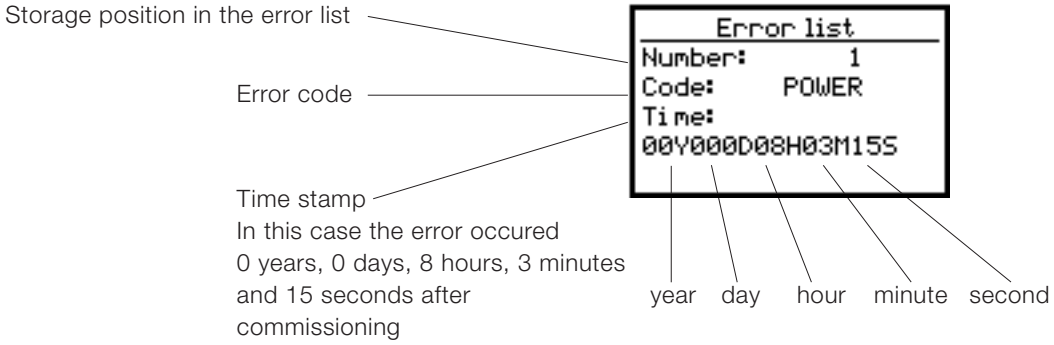
```
L1N: 230.0V
L2N: 230.3V
L3N: 229.7V
  49.61 Hz
Remote trip
R1 R2 R3 Y1 Y2 Y3
```

Remote trip

Shows that the remote trip is activated

Error memory

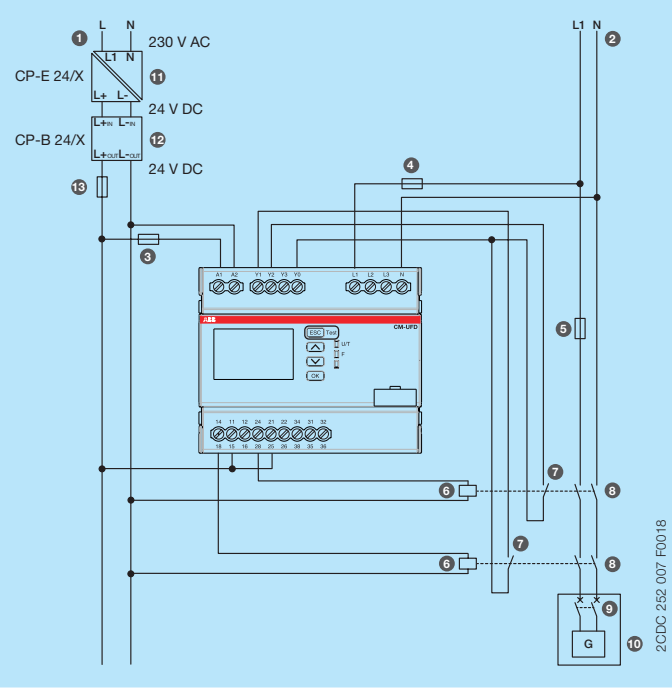
As soon as one of the above errors occurs, subsequent error codes with the corresponding time stamp will be stored in the error memory:



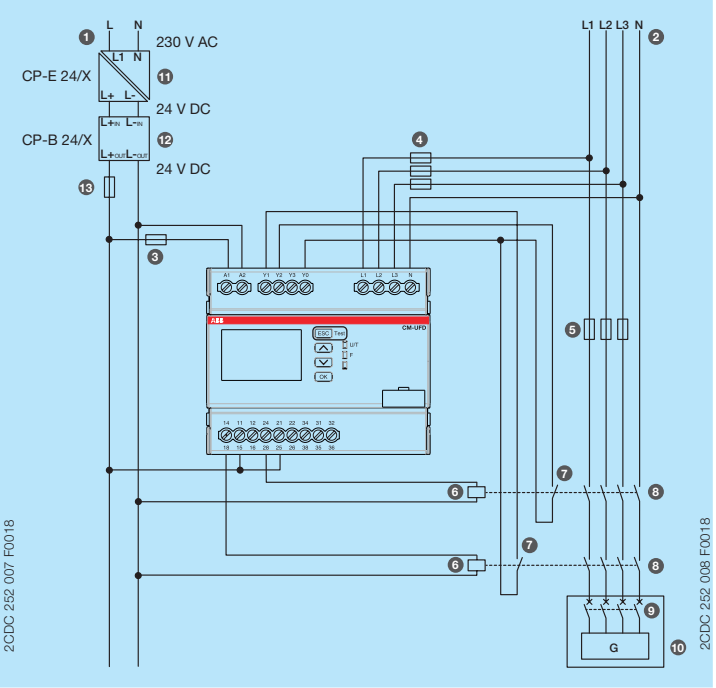
Error code	Explanation	
AVL1N>U_{AV} or AVL2N>U_{AV} or AVL3N>U_{AV}	Error, overvoltage U_{AV}	10-minutes average value
AVL12>U_{AV} or AVL23>U_{AV} or AVL31>U_{AV}	Error, overvoltage U_{AV}	10-minutes average value
L1N>U1 or L2N>U1 or L3N>U1	Error, overvoltage U1	
L12>U1 or L23>U1 or L31>U1	Error, overvoltage 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	Error, remote trip	
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

Connection and wiring

Example of single-phase application



Example of three-phase application



Legend

1. Control supply voltage for CM-UFD.M33
2. Public grid
3. Protection fuse for the CM-UFD.M33
4. Protection fuse for the measuring circuit of the CM-UFD.M33 (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	64 mA / 1.5 W
	230 V AC	6.4 mA / 1.5 VA
External fusing (necessary)		6 A gG (gL) or circuit breaker 6 A with B characteristic or acc. to UL requirements: 6 A class CC
Power failure buffering time		200 ms, according to LVFRT (Low Voltage Fault Ride Through)

Measuring circuits		L1, L2, L3, N
Measuring ranges	voltage (4-wire system L1, L2, L3-N)	0-317 V AC
	voltage (3-wire system L1, L2, L3)	0-550 V AC
	voltage (2-wire system L-N)	0-317 V AC
	frequency	40-70 Hz
Accuracy of measurements	voltage	≤ 0.5 % ± 0.5 V
	frequency	± 20 mHz
	delay times	≤ 0.1 % ± 20 ms
Accuracy within the temperature range		ΔU ≤ 0.02 %/°C
Monitoring functions	overvoltage 10-min average (>U_{AV})	threshold adjustable, 1.000-1.300*U_n in 0.005*U_n steps
	overvoltage (>U1)	threshold adjustable, 1.000-1.300*U_n in 0.005*U_n steps
	overvoltage (>U2)	threshold adjustable, 1.000-1.300*U_n in 0.005*U_n steps
	undervoltage (<U1)	threshold adjustable, 0.100-1.000*U_n in 0.005*U_n steps
	undervoltage (<U2)	threshold adjustable, 0.100-1.000*U_n in 0.005*U_n steps
	overfrequency (>F1)	threshold adjustable, 50.00-65.00 Hz in 0.01 Hz steps
	overfrequency (>F2)	threshold adjustable, 50.00-65.00 Hz in 0.01 Hz steps
	underfrequency (<F1)	threshold adjustable, 45.00-60.00 Hz in 0.01 Hz steps
	underfrequency (<F2)	threshold adjustable, 45.00-60.00 Hz in 0.01 Hz steps
	ROCOF	threshold adjustable, 0.100-5.000 Hz in 0.005 Hz steps
	vector shift	threshold adjustable, 2.0-40.0 ° in 0.1 ° steps
	interrupted neutral conductor	enabled if a measuring principle with neutral is selected
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)	adjustable, 0.5-10.0 % in 0.1 % steps
	overfrequency (>F1, >F2)	adjustable, 0.05-4.00 Hz in 0.01 Hz steps
	underfrequency (<F1, <F2)	adjustable, 0.05-4.00 Hz in 0.01 Hz steps
Measuring cycle of ROCOF		adjustable, 4-50 periods

Control circuits		Y0, Y1, Y2, Y3
Number		3
Type of triggering		volt-free triggering, signal source Y0
Control function	Y1-Y0 control input 1	feedback from switching device 1
	Y2-Y0 control input 2	feedback from switching device 2
	Y3-Y0 control input 3	remote trip; suppression of Y1, Y2, Y1/Y2 or vector shift detect.
Electrical isolation	from the supply voltage	yes
	from the measuring circuit	no
	from the relay outputs	yes
Maximum switching current in the control circuit		6 mA

No-load voltage at the control inputs (Y1-Y0, Y2-Y0, Y3-Y0)	22-26 V DC
Minimum control pulse length	20 ms
Maximum cable length at the control inputs (unshielded)	10 m

Timing functions

Switch-on delay (prior to first grid connection or re-connection after interruption)		adjustable, 0.05-600.00 s in 0.01 s steps
Tripping delay	overvoltage 10-min average (>U_{AV})	< 3 s
	overvoltage (>U1, >U2)	adjustable, 0.00-600.00 s in 0.01 s steps; +50 ms / -0 ms
	undervoltage (<U1, <U2)	adjustable, 0.00-600.00 s in 0.01 s steps; +50 ms / -0 ms
	overfrequency (>F1, >F2)	adjustable, 0.00-600.00 s in 0.01 s steps; +50 ms / -0 ms
	underfrequency (<F1, <F2)	adjustable, 0.00-600.00 s in 0.01 s steps; +50 ms / -0 ms
	ROCOF	adjustable, 0.00-600.00 s in 0.01 s steps; +50 ms / -0 ms
	vector shift	< 50 ms
	interrupted neutral conductor	< 150 ms
Error time	ROCOF	adjustable, 0.5-600.00 s in 0.01 s steps
	vector shift	adjustable, 0.5-600.00 s in 0.01 s steps
Overshoot time		< 25 ms
Trip window, feedback loops Y1-Y0, Y2-Y0		adjustable, 0.05-0.50 s in 0.01 s steps
Release window, feedback loop Y1-Y0, Y2-Y0		adjustable, 0.50-600.00 s in 0.01 s steps
Accuracy within the temperature range		$\Delta t \leq 0.01$ %

User interface

Indication of operational states		
Control supply voltage applied / timing	U/T	LED green on / flashing
Fault message	F	LED red on
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)
Operating temperature range of the display	clearly visible	-20...+60 °C
Resolution		112 x 64 pixel
Display size		36 x 22 mm

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

Output circuits

Kind of outputs	11-12/14 (15-16/18)	1st c/o (SPDT) contact, tripping relay for switching device 1
	21-22/24 (25-26/28)	2nd c/o (SPDT) contact, tripping relay for switching device 2
	31-32/34 (35-36/38)	3rd c/o (SPDT) contact, closing command for breaker motor
Operating principle	11-12/14	closed-circuit principle[1)]
	21-22/24	closed-circuit principle[1)]
	31-32/34	open-circuit, closed-circuit, disabled or synchronous with R1/R2 configurable
Contact material		AgNi alloy, Cd free
Rated operational voltage U_e		300 V AC
Minimum switching voltage / minimum switching current		24 V / 10 mA
Maximum switching voltage / maximum switching current		see 'Load limit curves'
Rated operating 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	50 x 10^3 switching cycles
Maximum fuse rating to achieve short-circuit protection	n/c contact	10 A fast-acting
	n/o contact	10 A fast-acting
Maximum closing current (short time)	t < 20 ms	30 A
	t < 80 ms	17 A
Conventional thermal current I_{th}		5 A

1) 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
Repeat accuracy (constant parameters)		< ± 0.5 %
Duty time		100 %
Dimensions		see 'Dimensional drawing'
Weight		0.306 kg (0.675 lb)
Material of housing		PA666FR
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 (0.315 in)
Tightening torque		0.5-0.6 Nm (4.4-5.3 lb.in)

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	supply / measuring / output circuits	600 V
	output 1 / output 2 / output 3	300 V
Rated impulse withstand voltage U_{imp}	supply / measuring / output circuits	6 kV; 1.2/50 µs
	output 1 / output 2 / output 3	4 kV; 1.2/50 µs
Basic insulation	supply / measuring / output circuits	600 V AC
	output 1 / output 2 / output 3	300 V AC
Protective separation (IEC/EN 61140)	supply / measuring / output circuits	250 V
	output 1 / output 2 / output 3	250 V
Pollution degree		3
Overvoltage category		III

Standards / Directives

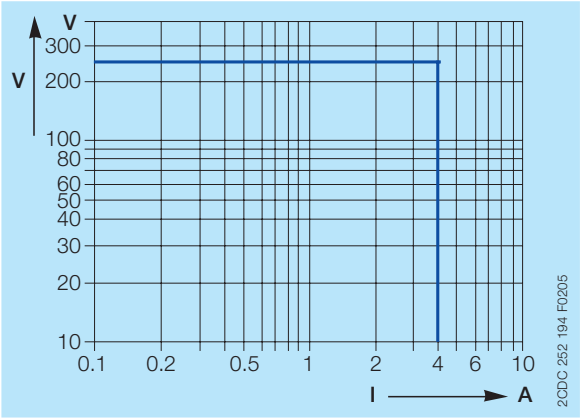
Standards	IEC/EN 60255-1, IEC/EN 60255-127, IEC/EN 60255-26, IEC/EN 60255-27
Great Britain Engineering Recommendation	G59 Issue 3 G83 Issue 2
Low Voltage Directive	2014/35/EU
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU

Electromagnetic compatibility

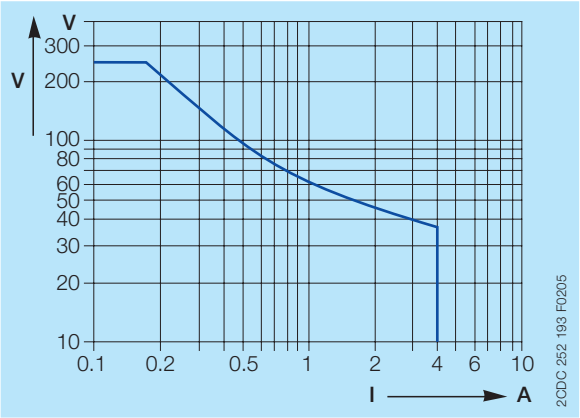
Interference immunity to		IEC/EN 61000-6-2
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV contact discharge, 8 kV air discharge
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3, 10 V/m
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3, 2 kV / 5 kHz
surge	IEC/EN 61000-4-5	Level 3, installation class 3, supply circuit and measuring circuit 1 kV L-L, 2 kV L-N
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
harmonics and interharmonics	IEC/EN 61000-4-13	Class 3
Interference emission		IEC/EN 61000-6-3
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B

Technical diagrams

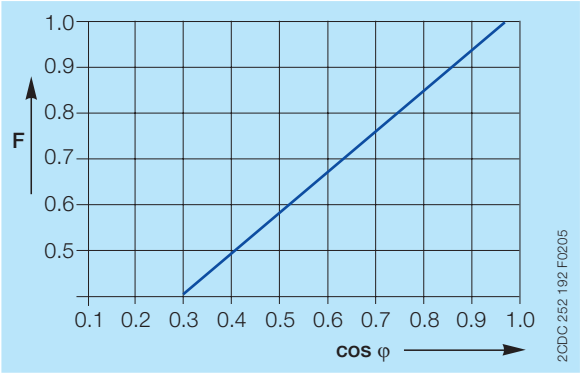
Load limits curves



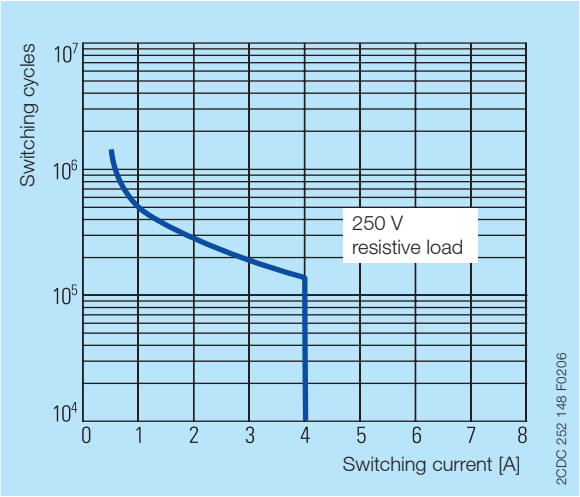
AC load (resistive)



DC load (resistive)



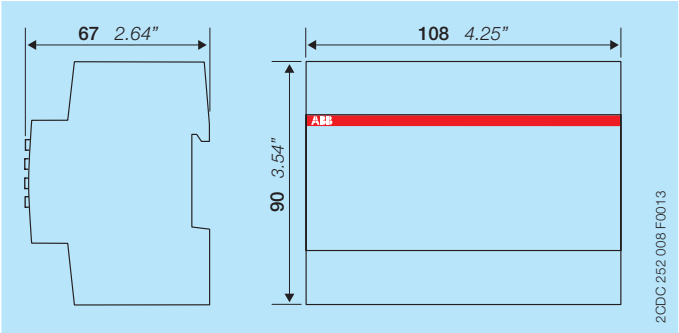
Derating factor F at inductive AC load



Contact lifetime

Dimensions

in **mm** and *inches*



Further documentation

Document title	Document type	Document number
Electronic relays and controls	Catalog	2CDC 110 004 C02xx
CM-UFD.M33 Grid feeding monitoring relay	Instruction sheet	1SVC 560 512 M0000

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.

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