

Grid feeding monitoring according to CEI 0-21 CM-UFD.M22

The CM-UFD.M22 is a multifunctional grid feeding monitoring relay. It provides different monitoring functions in accordance with CEI 0-21 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) can be configured.



2CDC 251 005 V0013

Characteristics

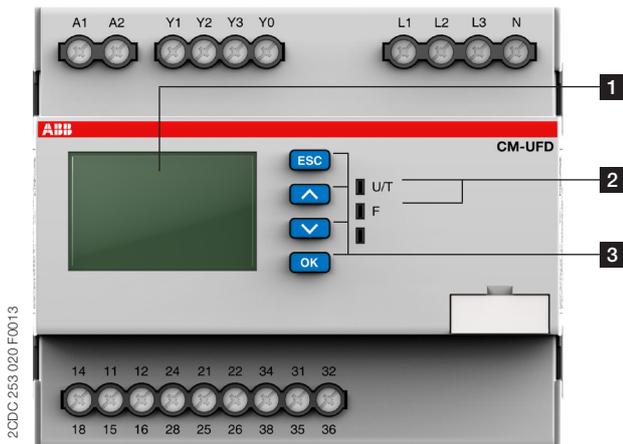
- Monitoring of voltage and frequency in single- and three-phase mains (2-wire, 3-wire or 4-wire AC systems)
- Type tested in accordance with CEI 0-21
- Over- and undervoltage, 10-minutes average value as well as over- and underfrequency monitoring
- Two-level threshold settings for over-/undervoltage and over-/underfrequency
- ROCOF (rate of change of frequency) monitoring configurable
- Interrupted neutral detection
- Integrated management of redundancy function (acc. to CEI 0-21, mandatory in plants with $P > 11.08$ kW)
- Default setting according to CEI 0-21
- True RMS measuring principle
- All threshold values and tripping delays adjustable
- Error memory for up to 99 entries (incl. cause of error, measured value, relative timestamp)
- Autotest function
- Password setting protection
- 3 control inputs, e.g. for feedback signal, remote trip
- 3 c/o (SPDT) contacts
- Multiline, backlit LCD display

Order data

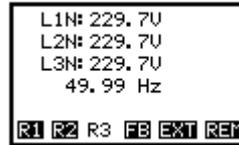
Type	Rated control supply voltage	Measuring range	Order code
CM-UFD.M22	24-240 V AC/DC	L-L: 0-540 V AC / L-N: 0-312 V AC	1SVR 560 730 R3400

Functions

Operating controls



1 Display



R1 R2 R3 - relay status; in this case R3 is de-energized
 FB - status feedback loop Y1-Y0; in this case FB is closed
 EXT - status input external signal; in this case input is closed
 REM - status remote trip input; in this case input is closed

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
 v: down / value decrease
 OK: enter / confirm selection

Application

The CM-UFD.M22 is a grid feeding monitoring relay (SPI), which is connected between the public grid and the distributed generation (GD) such as photovoltaic systems, wind turbines, block-type thermal power stations. It monitors the voltage and the frequency in the grid and will disconnect the distributed generation (GD) 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.

In conformity with CEI 0-21, the CM-UFD.M22 relay can be used in all low voltage plants and in medium voltage plants with power less than 30 kW. The SPI relay is mandatory in all low voltage generation plants with power > 11.08 kW or with more than 3 generators (e.g. plants with more than 3 inverters).

Operating mode

The CM-UFD.M22 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 pre-settings 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.M22 provides 3 output relays and 3 control inputs. The first output relay R1 (11₁₅-12₁₆/14₁₈) is required for disconnection of a distributed generation from the public grid (DDI). The corresponding feedback signal from the external contact is monitored via the first control input Y1-Y0 by the internal logic. The second output relay R2 (21₂₅-22₂₆/24₂₈) is redundant to the first one and only activated if output relay R1 has de-energized, but no changed state of the feedback from the external contact (DDI) has been recognized within the adjusted time delay. In case a feedback signal is present, the redundancy relay does not trip. Once the feedback loop did not change its status after the first output changed the status and the DDI should disconnect, the CM-UFD.M22 detects this as a failure (e.g. welded contacts of the DDI contactor) and trips the second output (rincalzo function).

The third output relay R3 (31₃₅-32₃₆/34₃₈) can be used for the closing command of a motor drive for circuit breaker. In case output relay R1 energizes, the adjusted ON-delay starts. When the ON-delay is complete, output relay R3 will be activated for the duration of the ON-time or until R1 de-energizes. In this last case the ON-time is inactive. It is also adjustable to synchronize tripping relay R3 with relay R1.

The operating principle of the relays R2 and R3 is configurable as normally energized (closed-circuit principle) or normally de-energized (open-circuit principle). For safety reasons, the operating principle of R1 is fixed as normally energized (closed-circuit principle).

Two additional control inputs allow to switch from remote between two sets of frequency threshold settings via Y2-Y0 or to trip the grid feeding monitoring relay via the control input Y3-Y0 (remote trip).

Protective functions

If control supply voltage is applied and all phases are present with voltage and frequency values within their permissible range, output relay R1 (DDI) energizes after the adjusted start-up delay and output relay R2 (DG) energizes or de-energizes, depending on the configuration, after a fixed delay of 1 s. Using the default factory setting, both output relays R1 (DDI) and R2 (DG) will be activated synchronously. The green LED U/T flashes while timing and turns steady when the start-up delay is complete.

If a measured value exceeds or falls below the set threshold value, output relay R1 (DDI) de-energizes after the adjusted delay. 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.

As soon as the measured value returns to the tolerance range, taking into account a fixed hysteresis, the red LED F turns off and output relay R1 (DDI) re-energizes after the adjusted re-start delay. The green LED U/T flashes while timing and turns steady when the delay is complete.

Protective function 59 S1 (10-minutes average value):

The CM-UFD.M22 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.

Redundancy functions

The redundancy relay R2 (DG) is activated if relay R1 (DDI) has de-energized and if no feedback from the external contact has been recognized by the internal logic via the first control input Y1-Y0 within the adjustable time delay. In case a feedback signal is present, the redundancy relay does not trip.

Output relay R3 (31₃₅-32₃₆/34₃₈)

Output relay R3 can be used for the closing command of a breaker motor. In case output relay R1 (DDI) 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 de-energizes. In this last case the ON-time is inactive. The operating principle of relay R3 is configurable as closed-circuit, open-circuit principle, disabled or synchronous with relay 1.

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 will detect zero crossings of the grid voltage. 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 relay will trip. After the adjusted error time the relay de-energizes automatically.

The ROCOF monitoring function is deactivated per default. It can be activated in the menu.

Interrupted neutral detection

Interrupted neutral detection is always active when 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 relay R1 (DDI).

Error memory

The CM-UFD.M22 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 "Error memory". The list is stored internally in a non-volatile memory which can be reset by the user.

Local command and external signal

The CEI 0-21 standard defines "restrictive thresholds", the under- and overfrequency thresholds S1 (49.5-50.5 Hz), and "permissive thresholds", the under- and overfrequency thresholds S2 (47.5-51.5 Hz). Selection of S1 or S2 thresholds is made by the corresponding combination of the external signal Y2-Y0 and the local command (see tables on page 4).

Working principle	Input state	Control input
normally open	open	0
normally open	closed	1
normally closed	open	1
normally closed	closed	0

Table: Truth table for control inputs External Signal Y2-Y0 and Remote trip Y3-Y0

External signal	Local command	Active thresholds
0	disabled	only S2
1	disabled	only S2
0	enabled	only S2
1	enabled	S1 and S2

Table: Truth table for frequency thresholds

Remote trip

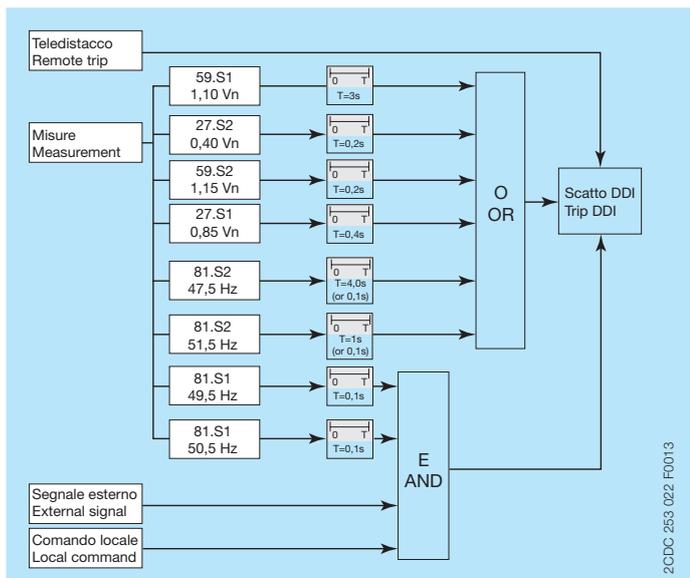
Control input Y3-Y0 allows tripping of the grid feeding monitoring relay from remote. The remote trip input can be configured as normally open or normally closed. If normally closed is configured, the relay trips if Y3-Y0 is opened. If normally open is configured, the relay trips if Y3-Y0 is closed. The output relay 11₁₅-12₁₆/14₁₈ is tripped by the remote trip within less than 20 ms. When the remote trip input is deactivated, the output relay 11₁₅-12₁₆/14₁₈ (DDI) energizes again.

Autotest

The autotest function allows the verification of the protective functions by increasing the lowest threshold and decreasing the highest threshold respectively, until the measured value for input voltage or frequency equals the threshold. Confirming the start of the autotest routine initiates the threshold sweep with the objective of tripping the relay. For each threshold the device displays the measured switching time up from tripping the output relay till the feedback signal from the external contact of the switching device. If the autotest fails, the cause of error has to be analysed and the test needs to be repeated. Output relay 11₁₅-12₁₆/14₁₈ remains de-energized as long as the test has not been passed successfully.

Note: The autotest will cause the CM-UFD.M22 to trip four times within a short time. This may lead to voltage fluctuations in the public grid. Therefore, we recommend to disconnect the generating plant manually from the grid before executing the auto test procedure.

Operating principle



Electrical connection

A1-A2	Control supply voltage
Y1-Y0	Control input 1 for feedback signal
Y2-Y0	Control input 2 for external signal
Y3-Y0	Control input 3 for remote trip
L1, L2, L3, N	Measuring input
11 ₁₅ -12 ₁₆ /14 ₁₈	1st c/o (SPDT) contact
21 ₂₅ -22 ₂₆ /24 ₂₈	2nd c/o (SPDT) contact
31 ₃₅ -32 ₃₆ /34 ₃₈	3rd c/o (SPDT) contact

20DC 253 023 F0013

Configuration

The relay is delivered with default settings in accordance to CEI 0-21 table 8. 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

- With a dark display, 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.

Password protection

Every CM-UFD.M22 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.

Default setting table

Protective functions	Threshold		Tripping delay
	relative	absolute	
1st overvoltage av. (59 S1)	1.10 V_n	253 V	
2nd overvoltage (59 S2)	1.15 V_n	265 V	0.2 s
1st undervoltage (27 S1)	0.85 V_n	196 V	0.4 s
2nd undervoltage (27 S2)	0.40 V_n	92 V	0.2 s
1st overfrequency (81 > S1)		50.5 Hz	0.1 s
1st underfrequency (81 < S1)		49.5 Hz	0.1 s
2nd overfrequency (81 > S2)		51.5 Hz	0.1 s
2nd underfrequency (81 < S2)		47.5 Hz	0.1 s

Note: The voltage values in this table refer to phase-neutral (V_n 230 V).

Indication of operational states

LED	Status information
U/T: green LED ON	Control supply voltage applied
U/T: green LED flashing	Timing
F: red LED ON	Failure

Menu structure

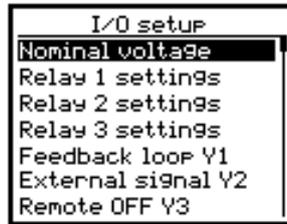
Main menu displays



OK →

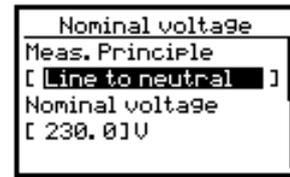
← ESC

Submenus displays



OK →

← ESC



∨ down

up ^

∨ down

up ^

Main menu displays	Submenus displays	Options	Configuration possibilities	Step size
Nominal voltage	Meas. principle		[3L-N], [3L-L], [1L-N]	
	Nominal voltage		[100.0] - [230.9] V L-N / [173.2] - [400.0] V L-L	0.1 V
I/O setup	Relay 1 settings	Start-up delay	[1.00] - [600.00] s	0.05 s
		Restart delay	[0.05] - [600.00] s	0.05 s
	Relay 2 settings	Working principle	[closed-circuit], [open-circuit]	
	Relay 3 settings	Working principle	[closed-circuit], [open-circuit], [disabled], [sync. with relay 1]	
		ON-delay	[0.00] - [10.00] s	0.05 s
		ON-time	[0.05] - [10.00] s	0.05 s
		Feedback loop Y1	Working principle	[normally closed], [normally open], [auto detection]
		Trip window	[0.05] - [0.50] s	0.05 s
		Release window	[0.50] - [600.00] s	0.05 s
	External signal Y2	Working principle	[normally closed], [normally open]	
Remote trip Y3	Working principle	[normally closed], [normally open]		
Monitoring func.	Overvoltage >S1	Threshold value	[1.00] - [1.20] * U _n	0.01 * U _n
	Overvoltage >S2	Threshold value	[1.00] - [1.30] * U _n	0.01 * U _n
		Tripping delay	[0.05] - [600.00] s	0.05 s
	Undervoltage <S1	Threshold value	[0.20] - [1.00] * U _n	0.01 * U _n
		Tripping delay	[0.05] - [600.00] s	0.05 s
	Undervoltage <S2	Threshold value	[0.05] - [1.00] * U _n	0.01 * U _n
		Tripping delay	[0.05] - [600.00] s	0.05 s
	Overfrequency >S1	Threshold value	[50.0] - [54.0] Hz	0.1 Hz
		Tripping delay	[0.05] - [600.00] s	0.05 s
	Overfrequency >S2	Threshold value	[50.0] - [54.0] Hz	0.1 Hz
		Tripping delay	[0.05] - [600.00] s	0.05 s
	Underfrequency <S1	Threshold value	[46.0] - [50.0] Hz	0.1 Hz
		Tripping delay	[0.05] - [600.00] s	0.05 s
	Underfrequency <S2	Threshold value	[46.0] - [50.0] Hz	0.1 Hz
		Tripping delay	[0.05] - [600.00] s	0.05 s
	ROCOF	ROCOF	[disabled], [enabled]	
Threshold value		[0.1] - [1.0] Hz/s	0.1 Hz/s	
	Error-time	[0.05] - [600.00] s	0.05 s	
Autotest				
General settings	Local command	Local command	[disabled], [enabled]	
		Change LC password	[****]	
	Language	Language	[English], [Italiano]	
	Display	Switch-off delay	[10] - [600] s	1 s
		Contrast	[0] - [9]	
	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				

Display and failure messages

```

Password
Enter Password
E4W3
    
```

When entering, the password is required, in this case E4W3

```

L1N: 199.9V
L2N: 200.1V
L3N: 199.7V
49.99 Hz RCOF
R1 R2 R3 FB EXT REM
    
```

Error, RCOF

```

L1N: 260.2V >S1
L2N: 260.3V >S1
L3N: 260.0V >S1
49.99 Hz
R1 R2 R3 FB EXT REM
    
```

Error overvoltage S1 in all three phases detected.

If overvoltage occurs in one phase only, >S1 indicates the phase with overvoltage.

```

Neutral conductor
is not connected!
R1 R2 R3 FB EXT REM
    
```

4-wire connection

The neutral conductor is disconnected or interrupted.

Please check wiring.

```

L1N: 264.6V >S2
L2N: 264.9V >S2
L3N: 264.6V >S2
49.99 Hz
R1 R2 R3 FB EXT REM
    
```

Error overvoltage S2 in all three phases detected.

If overvoltage occurs in one phase only, >S2 indicates the phase with overvoltage.

```

L1N: 230.4V
L2N: 230.6V
L3N: 230.3V
49.99 Hz
R1-FB Press ESC!
R1 R2 R3 FB EXT REM
    
```

Failure in the feedback loop FB. E.g. wiring failure, configuration failure, welded feedback contact in DDI.

Please check configuration and installation for failures. After failure removal, press ESC to restart/reset.

```

L1N: 190.3V <S1
L2N: 190.5V <S1
L3N: 190.1V <S1
49.99 Hz
R1 R2 R3 FB EXT TSC
    
```

Error undervoltage S1 in all three phases detected.

If undervoltage occurs in one phase only, <S1 indicates the phase with undervoltage.

```

L1N: 220.5V
L2N: 220.6V
L3N: 220.4V
49.99 Hz
R1-FB check loop!
R1 R2 R3 FB EXT REM
    
```

Permanent failure in the feedback loop FB. E.g. wiring failure, configuration failure, welded feedback contact in DDI.

Failure in configuration or installation must be removed before the failure can be accepted with ESC.

```

L1N: 90.2V <S2
L2N: 90.3V <S2
L3N: 90.2V <S2
49.99 Hz
R1 R2 R3 FB EXT REM
    
```

Error undervoltage S2 in all three phases detected.

If undervoltage occurs in one phase only, <S2 indicates the phase with undervoltage.

```

L1N: 229.9V
L2N: 229.2V
L3N: 229.1V
49.99 Hz
Internal error
R1 R2 R3 FB EXT REM
    
```

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: 230.4V
L2N: 230.5V
L3N: 230.2V
51.00 Hz >S1
R1 R2 R3 FB EXT TSC
    
```

Error overfrequency S1 detected

```

Autotest
U> 230.2V 16ms
Autotest failed
R1 R2 R3 FB EXT REM
    
```

Feedback of DDI interrupted or failure.

```

L1N: 230.3V
L2N: 230.5V
L3N: 230.1V
51.99 Hz >S2
R1 R2 R3 FB EXT TSC
    
```

Error overfrequency S2 detected

```

L1N: 229.9V
L2N: 230.2V
L3N: 229.9V
49.99 Hz
Autotest failed
R1 R2 R3 FB EXT REM
    
```

Main display / start display after autotest failure. Restart autotest

```

L1N: 230.5V
L2N: 230.7V
L3N: 230.3V
49.00 Hz <S1
R1 R2 R3 FB EXT TSC
    
```

Error underfrequency S1 detected

```

L1N: 229.9V
L2N: 230.3V
L3N: 229.7V
49.99 Hz
Remote trip
R1 R2 R3 FB EXT REM
    
```

Remote trip shows that the remote trip is activated and output relay R1 is de-energized.

```

L1N: 230.6V
L2N: 230.7V
L3N: 230.5V
47.00 Hz <S2
R1 R2 R3 FB EXT TSC
    
```

Error underfrequency S2 detected

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:

Storage position in the error list

Error code

Time stamp

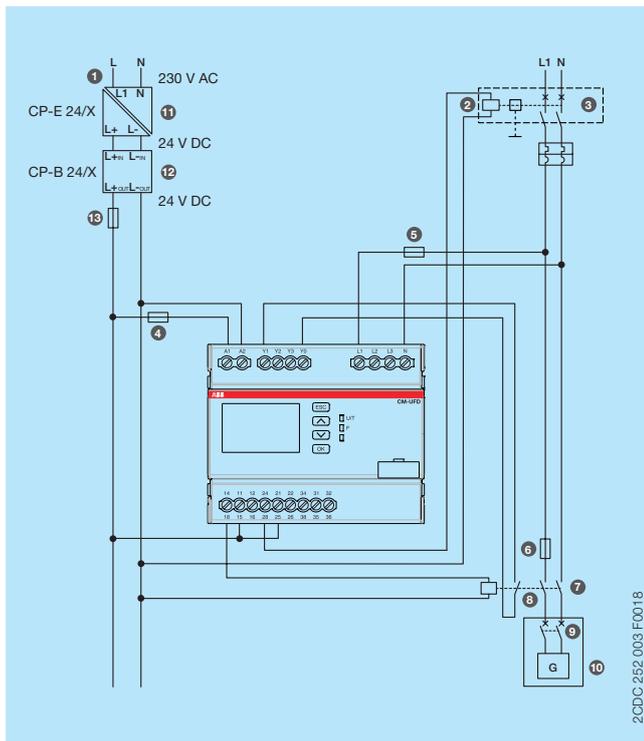
Error list	
Number:	1
Code:	POWER
Time:	00Y000D08H03M15S

In this case the error occurred
8 hours, 3 minutes and 15
seconds after commissioning

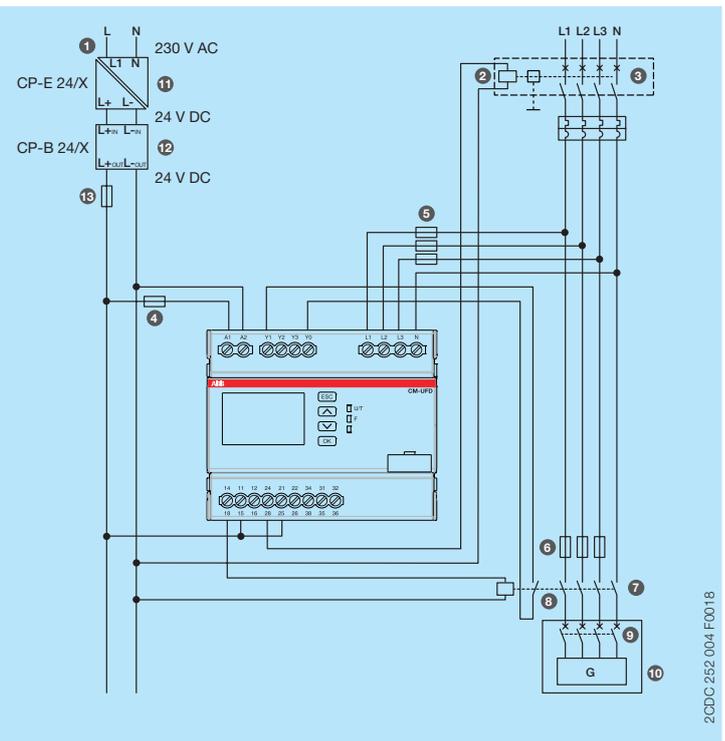
Error code	Explanation	
L1N>S1 or L2N>S1 or L3N>S1	Error, overvoltage S1	10-minutes average value
L1N>S2 or L2N>S2 or L3N>S2	Error, overvoltage S2	
L1N<S1 or L2N<S1 or L3N<S1	Error, undervoltage S1	
L1N<S2 or L2N<S2 or L3N<S2	Error, undervoltage S2	
L12>S1 or L23>S1 or L31>S1	Error, overvoltage S1	10-minutes average value
L12>S2 or L23>S2 or L31>S2	Error, overvoltage S2	
L12<S1 or L23<S1 or L31<S1	Error, undervoltage S1	
L12<S2 or L23<S2 or L31<S2	Error, undervoltage S2	
F>S1	Error, overfrequency S1	
F>S2	Error, overfrequency S2	
F<S1	Error, underfrequency S1	
F<S2	Error, underfrequency S2	
ROCOF	Error, ROCOF	
AUTO	Error, autotest	Failure during the autotest routine
REMOTE	Error, remote trip	
DDI-FB	Error, DDI feedback	Malfunction of the DDI
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. Main circuit breaker DG or DGL
2. DDI: Automatic circuit breaker or contactor equipped with low voltage coil and motor for automatic closure
3. Auxiliary contact of DDI, necessary for realizing the feedback function (compulsory for CM-UFD.M22)
4. DDI short-circuit protection
5. Generator and/or inverter
6. Generator (DDG)
7. Protection fuse for the measuring circuit of the CM-UFD.M22 (optional)
8. Shunt trip coil for feedback function ($P > 20$ kW). This coil can control DG/DGL or DDG devices
9. Control supply voltage for CM-UFD.M22 (SPI) and tripping device (DDI)*
10. Device protection fuse for the CM-UFD.M22
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

* In accordance to CEI 0-21 regulation, in case of loss of control supply voltage it's asked to guarantee, at least for 5 seconds, the functionality of the CM-UFD.M22, the operability of the DDI and when present the command coil for operating the redundancy device. This function has to be realized by external buffer or UPS devices.

Technical data

Data at $T_a = 25\text{ °C}$ 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 Hz
Frequency range AC		40-60 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
Power failure buffering time		200 ms, according to LVFRT (Low Voltage Fault Ride Through)
Measuring circuits		L1, L2, L3, N
Monitoring functions acc. to CEI 0-21		overvoltage av. (59 S1) overvoltage (59 S2) undervoltage (27 S1) undervoltage (27 S2) overfrequency (81>S1) underfrequency (81<S1) overfrequency (81>S2) underfrequency (81<S2) ROCOF, configurable neutral, activated if L-N
Measuring ranges	voltage (4-wire system L1, L2, L3-N)	0-312 V AC
	voltage (3-wire system L1, L2, L3)	0-540 V AC
	voltage (2-wire system L-N)	0-312 V AC
	frequency	40-60 Hz
Accuracy of measurements	voltage	$\leq 2\%$
	frequency	$\pm 20\text{ mHz}$
	delay times	$\leq 5\% \pm 20\text{ ms}$
Accuracy within the temperature range		$\Delta U \leq 0.02\%/\text{°C}$
Threshold values	overvoltage av. (59 S1)	adjustable, $1.00-1.20 \cdot U_n$ in $0.01 \cdot U_n$ steps
	overvoltage (59 S2)	adjustable, $1.00-1.30 \cdot U_n$ in $0.01 \cdot U_n$ steps
	undervoltage (27 S1)	adjustable, $0.20-1.00 \cdot U_n$ in $0.01 \cdot U_n$ steps
	undervoltage (27 S2)	adjustable, $0.05-1.00 \cdot U_n$ in $0.01 \cdot U_n$ steps
	overfrequency (81>S1)	adjustable, 50.0-54.0 Hz in 0.1 Hz steps
	underfrequency (81<S1)	adjustable, 46.0-50.0 Hz in 0.1 Hz steps
	overfrequency (81>S2)	adjustable, 50.0-54.0 Hz in 0.1 Hz steps
	underfrequency (81<S2)	adjustable, 46.0-50.0 Hz in 0.1 Hz steps
	ROCOF	adjustable, 0.1-1.0 Hz/s in 0.1 Hz/s steps
Hysteresis related to the threshold values	overvoltage	$0.95-0.97 \cdot U_n$
	undervoltage	$1.03-1.05 \cdot U_n$
	overfrequency	$0.997-0.999 \cdot f_n$
	underfrequency	$1.001-1.003 \cdot f_n$
Tripping delay acc. to CEI 0-21	overvoltage 2	adjustable, 0.05-600.00 s in 0.05 s steps,
	undervoltage 1	$\pm 3\% \pm 20\text{ ms}$
	undervoltage 2	
	overfrequency 1	
	overfrequency 2	
	underfrequency 1	
	underfrequency 2	
Tripping delay interrupted neutral conductor		$< 150\text{ ms}$
Measuring cycle at 50 Hz	ROCOF	640 ms

Control circuits		Y0, Y1, Y2, Y3
Number		3
Type of triggering		volt-free triggering, signal source Y0
Control function	Y1-Y0 control input 1	DDI feedback, trip and release monitoring times adjustable
	Y2-Y0 control input 2	external signal
	Y3-Y0 control input 3	remote trip
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

Start-up delay R1 (prior to first grid connection or re-connection after interruption)		adjustable, 1.00-600.00 s in 0.05 s steps
Restart delay R1		adjustable, 0.05-600.00 s in 0.05 s steps
Start-up delay R2 (prior to first grid connection or re-connection after interruption)		1 s, fixed
ON-delay R3		adjustable, 0.00-10.00 s in 0.05 s steps
ON-time R3		adjustable, 0.05-10.00 s in 0.05 s steps
Trip window, feedback loop Y1		adjustable, 0.05-0.50 s in 0.05 s steps
Release window, feedback loop Y1		adjustable, 0.50-600.00 s in 0.05 s steps
Tripping delays		adjustable, 0.05-600.00 s in 0.05 s steps
ROCOF error time		adjustable, 0.05-600.00 s in 0.05 s steps

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 DDI
	21-22/24 (25-26/28)	2nd c/o (SPDT) contact, redundancy relay for DG
	31-32/34 (35-36/38)	3rd c/o (SPDT) contact, closing command for breaker motor, also sync. with relay 1
Operating principle	11-12/14	closed-circuit principle ¹⁾
	21-22/24	open- or closed-circuit principle ¹⁾ configurable
	31-32/34	open- or closed-circuit principle ¹⁾ configurable
Contact material		AgNi alloy, Cd free
Rated operational voltage U_e		250 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 occurring
 Open-circuit principle: Output relay energizes if a fault is occurring

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 mm ² (1 x 24-12 AWG)
		2 x 0.25-0.75 mm ² (2 x 24-18 AWG)
	fine-strand without wire end ferrule	1 x 0.2-4 mm ² (1 x 24-12 AWG)
		2 x 0.2-1.5 mm ² (2 x 24-16 AWG)
	rigid	1 x 0.2-6 mm ² (1 x 24-10 AWG)
		2 x 0.2-1.5 mm ² (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 μ s
	output 1 / output 2 / output 3	4 kV; 1.2/50 μ s
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	IEC/EN 60664-1	III
Overvoltage category	CEI 0-21	IV

Standards / Directives

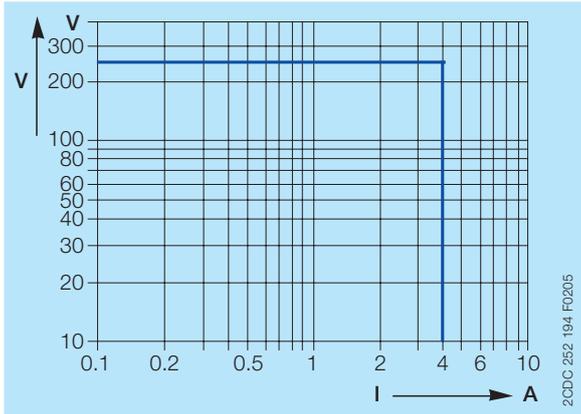
Standards	IEC/EN 60255-27, EN 50178, CEI 0-21
Low Voltage Directive	2014/35/EU
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU

Electromagnetic compatibility

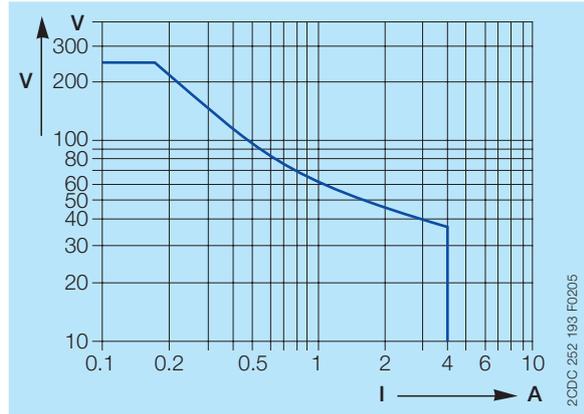
Interference immunity to		IEC/EN 61000-6-2, CEI 0-21 Tab.11
electrostatic discharge	IEC/EN 61000-4-2	Level 3, 6 kV contact discharge, 8 kV air discharge
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3, 10 V/m
electrical fast transient / burst	IEC/EN 61000-4-4	Level 3, 2 kV / 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

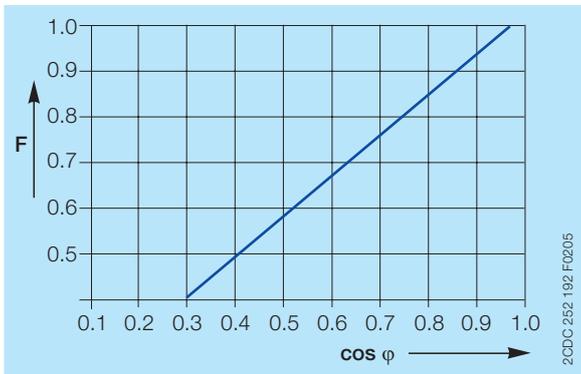
Load limits curves



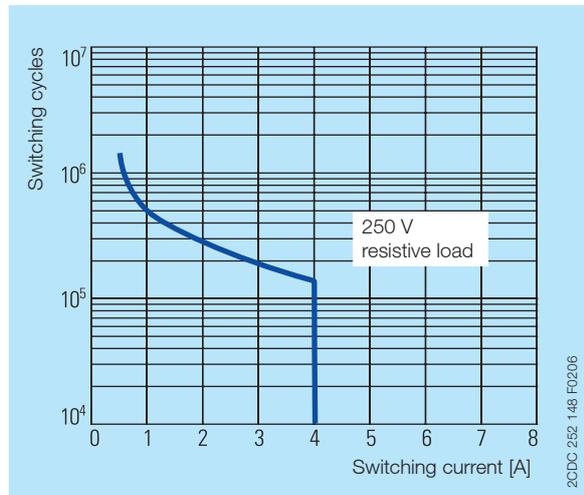
AC load (resistive)



DC load (resistive)



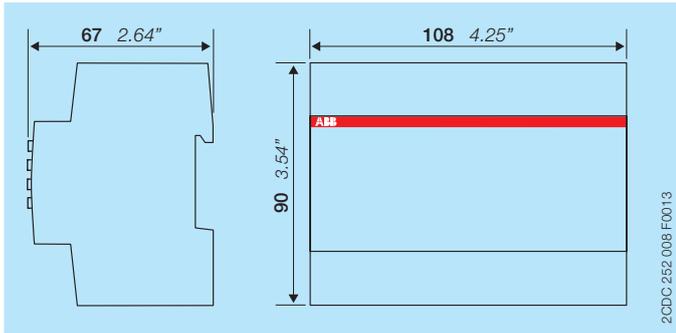
Derating factor F at inductive AC load



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.M22 Grid feeding monitoring relay	Instruction sheet	1SVC 560 510 M0001

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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