MANUAL MOTOR STARTER GUIDE

Manual motor starter

MS116, MS132 and MS165

1.7.3 European Directives referred to ATEX

Commonly referred to as ATEX, from the French “ATmosphères EXplosibles”, this European Directives is a combination of two EU directives: The Worker Protection Directive 1999/92/EC and the Product Directive 2014/34/EU. This provides guidelines similar to the IECEx system, with a few exceptions, and without the certification of service facilities and certification of personnel competencies. Compliance with the “Essential Health and Safety Requirements” described in the directives is mandatory within the European Union countries. The easiest way to show compliance is to follow harmonized standards.

1.7.4 Potentially explosive atmospheres groups, zones, categories and devices

Within industries, all potentially explosive atmospheres are required to have an area classification referred to as the zone system. The zone system is used all over the world and nowadays also accepted as an alternative system in North America.

Authorities normally determine the area, but it can also be performed by a third party; a notified body or other expert. It is the owner’s responsibility to ensure that the classification of their site is performed before suitable products can be selected and installed at the location.

Globally, a zone system is used to classify potentially explosive areas. The Worker Protection Directive 1999/EC and the international standards IEC / EN 60079-10-x define these zones. In all cases, zone classification for potentially explosive atmospheres, zones, categories and devices are the responsibility of the owner of the site where the potentially explosive atmosphere exists.

There are 6 zones:

- **Zone 0** (for gas) and **20** (for dust), where there is a continuous presence of an explosive atmosphere.
- **Zone 1** (for gas) and **21** (for dust), where there is an occasional occurrence of a potentially explosive atmosphere.
- **Zone 2** (for gas) and **22** (for dust), where potentially explosive atmospheres can occur by accident, not during normal operation.

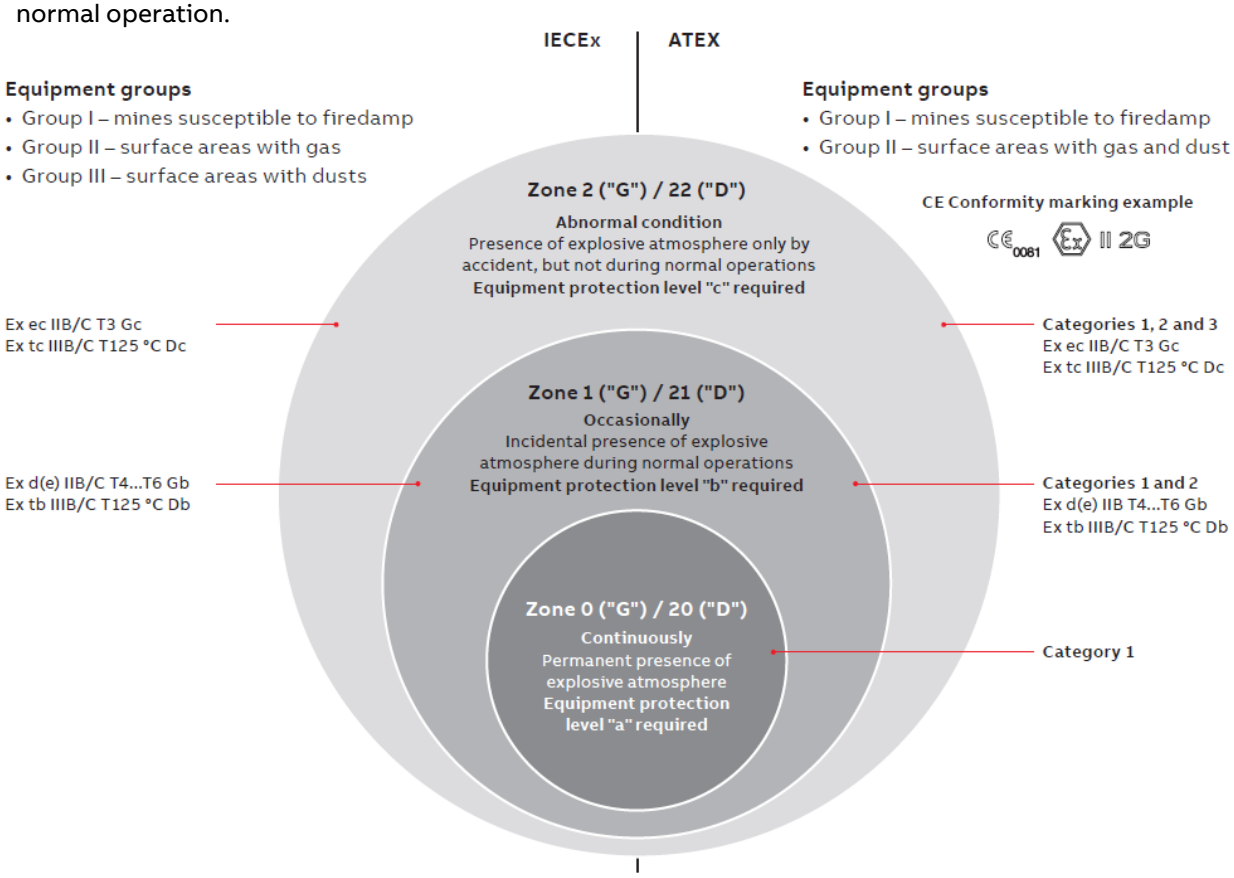
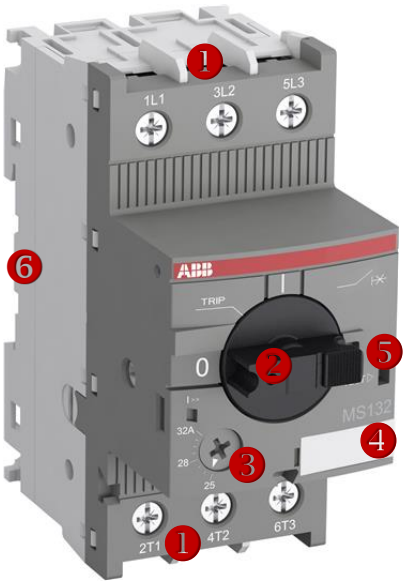


Figure 1: Potentially explosive atmosphere groups, zones, categories and devices. “G” = Gas; “D” = Dust

2. General product overview

2.1 Basic function

Manual motor starters protect the motor and the installation against short-circuits and overloads. They are three pole electro-mechanical protection devices with a release for overload protection and short-circuit protection. Furthermore, they provide a disconnect function for safe isolation of the installation and the power supply and the can be used for switching loads ON and OFF manually.



❶ **Power terminals**

They allow the connection of up to two conductors with different cross-sections for the main.

❷ **ON/OFF handle (operator)**

For switching ON and OFF; indication of a possible trip; with integrated shut-off device. Switching on and off must be done quickly and without interruption.

❸ **Current setting dial**

The dial makes it easy to set the device to the rated motor current.

❹ **Label for marking**

❺ **TEST-Function**

Allows testing of the trigger mechanism.

❻ **DIN rail mounting**

Allows mounting the device on DIN rails 35x15 mm and 35x7.5 mm.

Figure 2: Basic function shown on MS132

Manual motor starters are approved according IEC / EN 60947-2, IEC / EN 60947-4-1 and UL 60947-4-1A (previously UL 508). The protection function is realized with the following sub-functions:

- overload protection
- short-circuit protection
- phase loss sensitivity

Upon detection of a fault, the manual motor starter disconnects all phases from the supply, directly isolating the protected load. In addition, manual motor starters increase the device reliability by reacting quickly, protecting against damage to the load-side circuits and motor by operating within milliseconds following a short-circuit fault.

The term “manual motor starter” is not directly stated in either standard, with the terms for the UL “Manual Motor Controller” or “Combination Motor Controller” used as these terms refer to these devices. For the International Electrotechnical Commission (IEC), these devices are referred to as “motor protection circuit-breaker (MPCB)” or simply “circuit- breakers”.

Other common aliases for a manual motor starter include:

- motor-protective circuit-breakers (MPCB)
- manual motor protectors (MMP)
- manual motor controllers (MMC)
- manual starter protectors (MSP)
- motor circuit protectors (MCP)
- motor protection (MP)

2.4 Product offering

ABB provides a comprehensive manual motor starter. Worldwide the manual motor starters device types are divided into three ranges to simplify selection, coordination, and installation:

- MS116 with a standard performance range up to 32 A
- MS132 / MO132 with high performance ranges up to 32 A
- MS165 / MO165 with high performance ranges up to 80 A
- MS132-T with high performance ranges for transformer protection

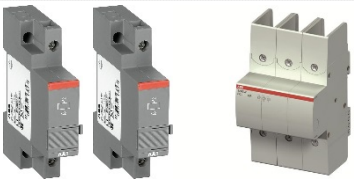
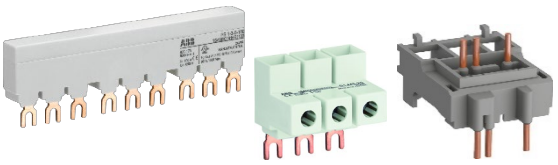
	 MS116	 MS132 MS132-K	 MS165	 MS132-T MS132-KT
Thermal protection	X	X	X	X
Electromagnetic protection	X	X	X	X
Phase loss sensitivity	X	X	X	X
Switch position	ON/OFF	ON/OFF/TRIP	ON/OFF/TRIP	ON/OFF/TRIP
Magnetic trip indication		X	X	X
Lockable handle without accessories		X	X	X
Disconnection function	X	X	X	X
Width	45 mm	45 mm	55 mm	45 mm
Rated operational current I_e	0.1 ... 32 A	0.1 ... 32 A	10 ... 80 A	0.1 ... 25 A
Short circuit breaking capacities	up to 100 kA	up to 100 kA	up to 100 kA	up to 100 kA
Ambient air temperature (w/o derating)	-25 ... +55 °C	-25 ... +60 °C	-25 ... +60 °C	-20 ... +60 °C

	 MO132	 MO165
Thermal protection		
Electromagnetic protection	X	X
Phase loss sensitivity		
Switch position	ON/OFF/TRIP	ON/OFF/TRIP
Magnetic trip indication		
Lockable handle without accessories	X	X
Disconnection function	X	X
Width	45 mm	55 mm
Rated operational current I_e	0.1 ... 32 A	10 ... 80 A
Short circuit breaking capacities	up to 100 kA	up to 100 kA
Ambient air temperature (w/o derating)	-25 … +60 °C	-25 ... +60 °C

Table 8: Product range of all manual motor starters.

2.4.6 Accessories and enclosures

Since manual motor starters combine the functions of multiple components, such as circuit-breakers, disconnect switches, and overload relays, they are offered with many of the same types of accessories. Thus, the manual motor starters can be extended with auxiliary contacts which can be connected either on the side or - especially to save space - on the front. Also, undervoltage releases are available, and shunt releases complement the product range. With the help of separately available adapters can the manual motor starter easily and quickly, build to a compact starter combinations of motor protection switch and contactor.

Signaling and status indication	Auxiliary contacts **HK1, HKF1** Signal contact alarms **SK1** Short-circuit signaling contact **CK1**	
Increasing functionality	Undervoltage releases **UA1** Shunt trips **AA1** Current limiters **S803W**	
Reducing installation time and saving space	Three-phase busbar **PSx** Feeder (in-feed) terminal blocks **S1-Mx** Connecting Link **BEA**	
External operation and enclosures	Handles and shafts, NEMA Types 1, 3R, 12 Shaft alignment accessories Door-mount kits, NEMA Type 12 **DMS132** Enclosures, NEMA Type 12 **IB132**	

Auxiliary and signaling contacts can be combined to provide external status indication for a variety of conditions and states. The table below shows an overview of the functionality of these contact types.

Contact type			Condition / state of manual motor starter					
			OFF	ON	Signaling contact	Short-circuit trip	Undervoltage release	Shunt trip
HK1, HKF1 *Auxiliary contacts*	Change position with the main contacts	Normally-open	O	X	O	O	O	O
		Normally-closed	X	O	X	X	X	X
SK1 *Signal contact alarms*	Signals tripping by short-circuit or overload	Normally-open	O	O	X	X	X	X
		Normally-closed	X	X	O	O	O	O
CK1 *Short-circuit indicators*	Signals tripping by short-circuit	Normally-open	O	O	O	X	O	O
		Normally-closed	X	X	X	O	X	X

O = Open; X = Closed

Table 9: Condition / state of manual motor starter.

7.4 Functional requirements for all motor branch circuits

The installation standards for North America require that each motor branch circuit contains electrical components capable of meeting four functional requirements: a disconnect means, short-circuit and ground-fault protection, a control means, and overload protection. This can be achieved of using either multiple components or a single device. A detailed description of the functional branch requirements will be shown in the next chapter.

Functional branch requirements	Components					Combination Motor Controllers
1. Disconnect means +	Fusible disconnect switches UL 98 CSA C22.2 No.4	Non-fusible disconnect switches UL 98 CSA C22.2 No.4	Inverse-time circuit-breakers UL 489 CSA C22.2 No.5	Molded case switches UL 489 CSA C22.2 No.5	Manual motor starters UL 60947-4-1 CSA C22.2 No.60947-4-1	Combination Motor Controllers UL 60947-4-1 CSA C22.2 No.60947-4-1
2. Short-circuit and ground-fault protection +	Fuses UL 248 CSA C22.2 No.248	Inverse-time circuit-breakers UL 489 CSA C22.2 No.5			MMS only when Type E or F	Combination Motor Controllers UL 60947-4-1 CSA C22.2 No.60947-4-1
3. Control means +	Contactors UL 60947-4-1 CSA C22.2 No.60947-4-1	Softstarters UL 60947-4-1 CSA C22.2 No.60947-4-1	Variable frequency drives UL 508C CSA C22.2 No.274	Non-fusible disconnect switches UL 60947-4-1 CSA C22.2 No.60947-4-1	Manual motor starters UL 60947-4-1 CSA C22.2 No.60947-4-1	Combination Motor Controllers UL 60947-4-1 CSA C22.2 No.60947-4-1
4. Overload protection M	Overload relays UL 60947-4-1 CSA C22.2 No.60947-4-1	Universal motor controllers UL 60947-4-1 CSA C22.2 No.60947-4-1	Manual Motor Starters UL 60947-4-1 CSA C22.2 No.60947-4-1			Combination Motor Controllers UL 60947-4-1 CSA C22.2 No.60947-4-1
1a. Local disconnect (if required)	Non-fusible disconnect switches UL 60947-4-1 CSA C22.2 No.60947-4-1	Manual motor starters UL 60947-4-1 CSA C22.2 No.60947-4-1	...or any shown above next to 1. disconnect means			

Combination starter

Starter

Table 25: Functional requirements for all motor branch circuits

The chart above shows a graphical representation of the functional requirements for all motor branch circuits. Manual motor starters are capable of meeting all of the requirements listed above. However, in order for manual motor starters to be used for short-circuit and ground-fault protection, they must be additionally certified as Type E or F combination motor controllers.

7.5 Product offering for north American applications

ABB provides a comprehensive manual motor starter. The manual motor starters are divided into three ranges to simplify selection, coordination, and installation:

- MS116 standard range up to 32 A
- MS132 / MO132 high performance ranges up to 32 A
- MS165 / MO165 high performance ranges up to 80 A

MS116
0.10 … 32 Amps
Tripping Class 10A

MS132 / MO132
0.10 … 32 Amps
Tripping Class 10 (MS only)

MS165 / MO165
10 … 80 Amps
Tripping Class 10 (MS only)

The chart below shows an overview of ratings for manual motor starters by product type.

Rating	Manual motor starter type				
	MS116	MS132	MS165	MO132	MO165
Manual Motor Controller	X	X	X	X	X
Manual Motor Controller, Suitable as Motor Disconnect	X	X	X	X	X
Manual Motor Controller, Suitable for use in Group Installations	X	X	X	X	X
Manual Motor Controller, Suitable for Tap Conductor Protection in Group Installations		X	X	X	X
Manual self-protected Combination Motor Controller (Type E)		X	X		
Combination Motor Controller (Type F)		X	X	X	X
Protection of ABB Micro drives		X		Contact ABB	

Table 26: Product offering for North American applications.