

**ABB Inc.  
Medium Voltage  
Motor Control Center**

**Customer Presentation**



# Outline

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- Product Introduction
- Product Description
- Product Application
- Competition
- Target Market

# Product Introduction



# Medium Voltage Motor Control Centers

Medium voltage motor control centers (MVMCC) are devices used in switching loads such as motors, transformers and capacitors.

MVMCCs employ circuit breakers, power monitoring devices and programmable controllers in order to provide appropriate overload protection.



# Introduction

- ABB Medium Voltage Motor Control Center...

The ABB MVMCC design greatly improves maintenance simplicity. The enhancements in this product provide a superior solution for motor control for increased worker safety, enhanced reliability and ease of use.

- ANSI rated – constructed in accordance with UL 347

- Designed for:

- Flexible application -  
with a variety of configurations
- Operation & safety -  
with interlocks & shielding
- Maintenance simplicity -  
with window to view components
- Effective space utilization -  
with ample cable space



# A Quick Overview

- Complete range of ratings of 2.4 to 6.6 kV at 400 A and 720 A
- Applications for
  - Full voltage (reversing and non-reversing)
  - Reduce voltage autotransformer starter
  - Reduce voltage reactor transformer
  - Induction/ Synchronous (brush or brushless starter)
  - Available options:
    - Transition sections for close coupling to ABB SafeGear and Advance switchgear
    - Auxiliary section for larger cable entry applications
    - PT draw-out compartment
- One and two high fully rated stackable modules
- Versatile configurations
- Compact footprint (30" wide x 44" deep x 95" high)
- Available arc resistance construction in model 2



# Advance Center Main features

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- Manually operated isolation switch design
- Viewing window for visual verification of switch position as well as for viewing fuse trip indicators without opening the cell
- Removable contactor.
- Manual secondary disconnect
- CPT fixed mounted for primary and secondary fuse protection
- 100% front accessibility
- Room for cable stress cones (without bending cable)
- High CT accuracy class (C10, CA100)

# Product Description

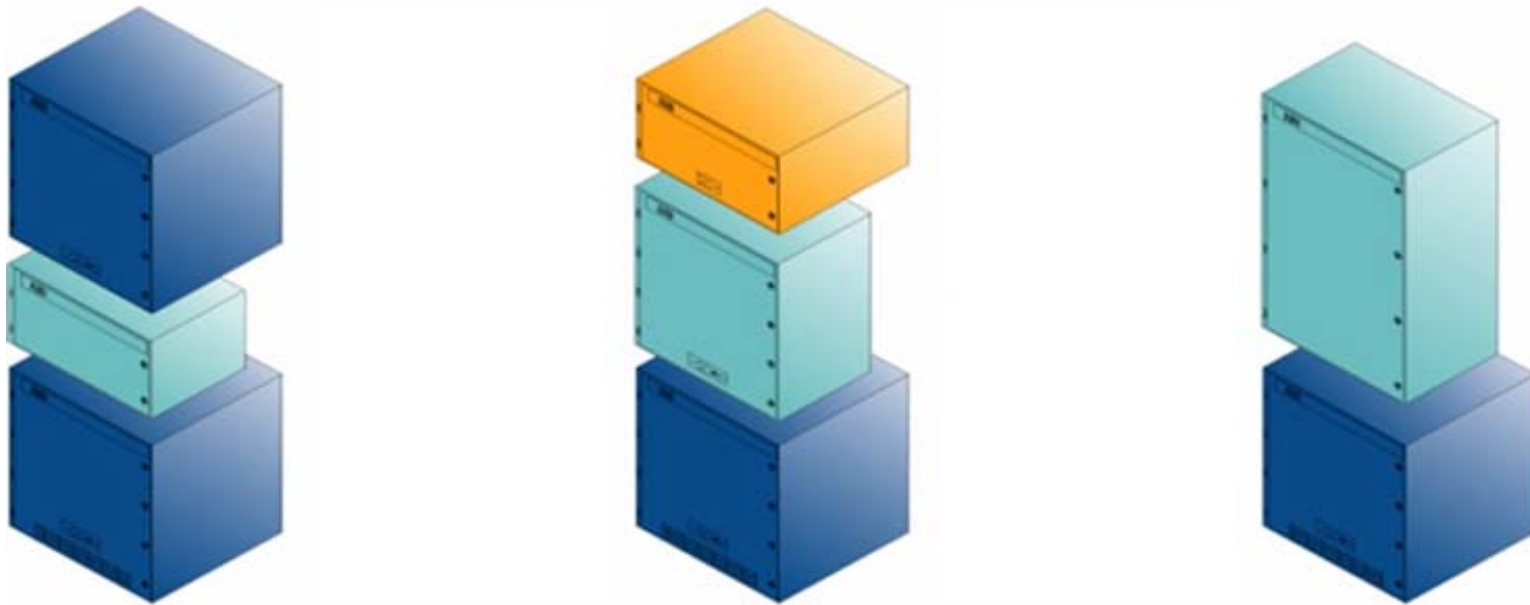




# Product Description

## ■ Modular Design – adapted technology

- Similar building blocks used in ABB SafeGear and Advance switchgear
- Bolted construction enables faster replacement and modification in the field
- Allows for easy replacements, repairs, and specialized configurations
- Maintains the smallest, compact product



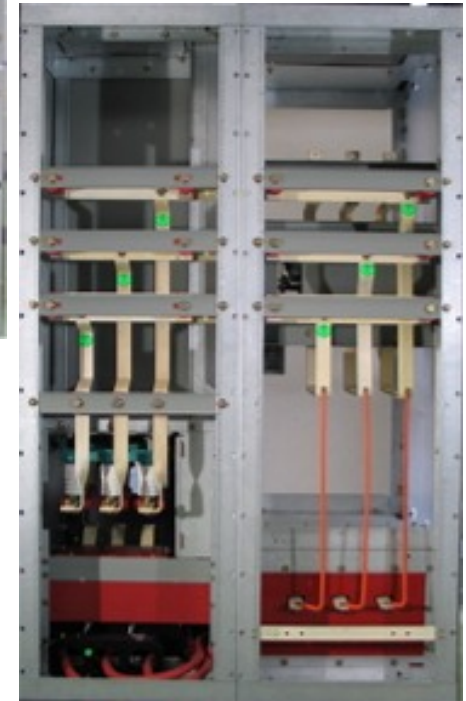
# Product Description

## ■ Enclosure

- NEMA 1, 1A for indoor or 3R non walk-in for outdoor
- Pre-coated Galvalume material throughout for superior resistance to corrosion, self-healing characteristics and makes for a bright interior
- Hem bends throughout construction greatly reducing exposure to sharp edges

## ■ Bus bar:

- 100% front access for easy inspection
- 1200 A, 2000 A, 3000 A with 50kA short circuit
- 400 A or 800 A vertical bus
- Silver plated copper bus standard, Tin plating is available
- Insulated bus available
- Joints covered with reusable boots, removable for inspection and maintenance



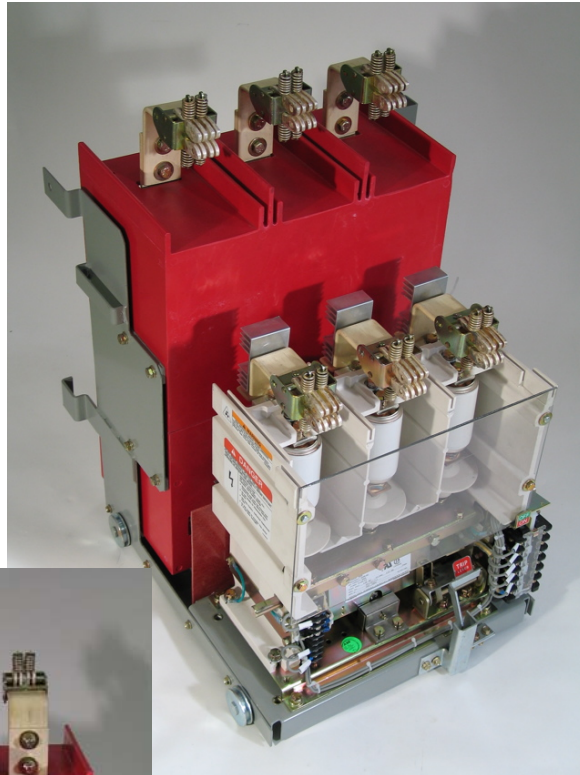
# Product Description

## ■ Isolation Switch

- Safety device to isolates contactor compartment from main bus
- Manual operated from the front with the door closed to avoid inadvertent operation
- Interlocks prevents:
  - isolation switch operation when the contactor is closed
  - opening cell door when switch is closed
  - isolation switch operation when the cell door is open
- A Lexan shield covers the isolation switch
  - providing protection from high voltage components
  - Shutters not needed
- Switch position viewable through the cell viewing window – allowing for visible break



# Product Description



## ■ Contactor

- Removable with automatic primary disconnect and manual secondary disconnect
- Vacuum interrupting
- 400 A, 720 A inside the cubicle
- Magnetic or mechanically held

## ■ Power Fuses

- Front vertical mounted fuses; clip or bolted
- Anti single phase fuse trip available upon request
- Fuse trip indicator viewable with door closed
- Type R for motor and E for transformer applications
- Fuse puller not needed for removal



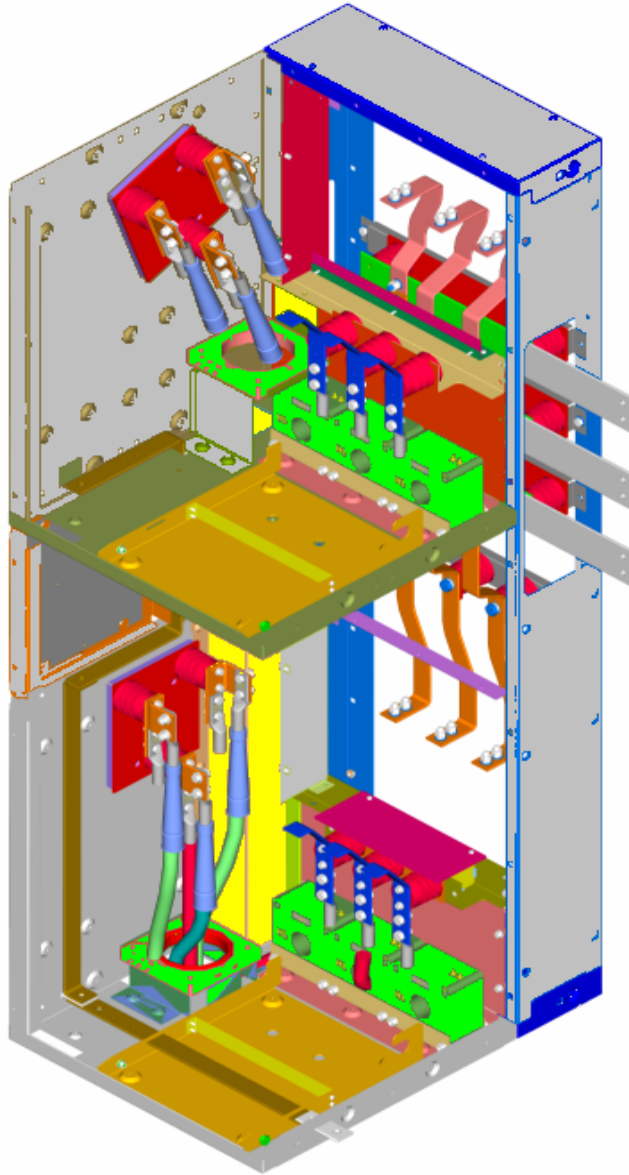
# Product Description

- **Control Power Transformer**
  - 500 VA standard, up to 1 kVA optional
  - Primary and secondary fuse protection
  - Fixed mounted for a lighter contactor truck
- **Phase Current Transformer**
  - Single phase window type
  - ANSI accuracy class
  - Fixed mounted for security
- **Zero Sequence CT**
  - Mounted at the entrance to the cable compartment





# Product Description



## ■ Power Cable Space

- Enhanced cable allocation provides 23" clearance from the bottom of each cell for shielded cable and stress cones
- A lexan shield protects terminal blocks and allows for visual inspection
- Top or Bottom cable entry
- Sufficient space for routing cables with no hard bends
- One 500MCM cable maximum per phase

# Product Description



## ■ LV Compartment

- Completely isolated LV instrument compartment for utmost safety
  - No instruments on contactor door
- Easy access for operation and maintenance to all control and protection devices
- Available in three sizes
  - 19", 38", and 57"
- Pre-coated Galvalume material makes for a bright interior

## ■ Configuration

- 400 A 2-high with fully rated upper and lower cells
- 720 A 1-high



# Product Summary

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- Safety
  - Hem bending process - eliminates sharp edges
  - LV components completely isolated from HV components
  - Isolation switch and redundant interlocks for protection
- Maintenance/ Ease of use
  - Ample cable space
  - Modular design
    - Reduces replacing cost
    - Reduces downtime
- Durability
  - Design based on metal clad switchgear
  - Hem bending process - Increases rigidity
  - Galvalume material – highly resistive to corrosion
- Local service



# Contactor Ratings

<i>Rating</i>	<i>Value</i>	
<i>Contactor Rating</i>	<i>400 A</i>	<i>720 A</i>
Interrupting ratings at 2.4, 5.0 & 6.6 kV		
NEMA unfused	25 / 50 / 60 MVA	30 / 60 / 85 MVA
NEMA fused	200 / 400 / 570 MVA	200 / 400 / 570 MVA
Short time current		
30 sec	2,400 A	4,320 A
1 sec	6,000 A	10,800 A
10 ms	85 kA (peak)	85 kA (peak)
Mechanical life, latched/unlatched*	250,000 / 2,500,000	250,000 / 1,000,000
Switching frequency (per hour)	300 / 12000	300 / 600
latched/unlatched		
Electrical life *	250,000	250,000
Impulse withstand	60 kV	60 kV
Dielectric strength	22 kV – 1 minute	22 kV – 1 minute
Maximum voltage level	7200 V	6900 V
Contactor close time (max)	4.8 cyc <sub>60 Hz</sub> (80 ms)	4.2 cyc <sub>60 Hz</sub> (70 ms)
Contactor open time (max)	1.5 cyc <sub>60 Hz</sub> (25 ms)	2.1 cyc <sub>60 Hz</sub> (35 ms)



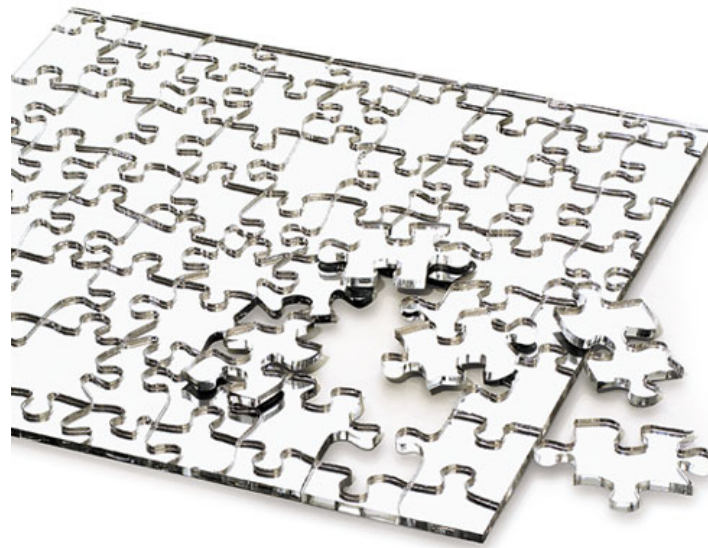
# Contactor Ratings

<b>Control ratings:</b>		
Contactor control voltage (ac/dc, levels)	Std: 120 V ac 50/60Hz  Option: 240 V ac / 125 V dc 250 V dc	115-240 V ac / 125-250 V dc
Pickup voltage ac or dc	85% (hot) – 70% (cold)	85% (hot) – 70% (cold)
Dropout voltage ac or dc	50% (hot) – 40% (cold)	50% (hot) – 40% (cold)
Burden closing	670 VA (ac) – 700 W (dc)	840 VA (ac) – 875 W (dc)
Burden holding	85 VA (ac) – 85 W (dc)	48 VA (ac)
<b>Auxiliary Contact</b>	3NO, 3NC 2NO, 3NC (latched)	3NO, 3NC
Max voltage	600 V	600 V
Continuous current	10 A	10 A
Making capacity	7200 VA	7200 VA
Breaking capacity	720 VA	720 VA
<b>Ambient Ratings</b>		
Altitude without derating	6600 ft	6600 ft
Temperature	-5 to 40°C	-5 to 40°C
Humidity	45-85%	45-85%
Vibration	20 Hz – 1G	20 Hz – 0.5G
<b>Frames per shipping split</b>	3	3

\* Maximum required for testing. Actual life is greater under normal operations and conditions.



# Product Application



# Product Applications

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- FVNR Full Voltage Non Reverse
- FVR Full Voltage Reverse
- RVAT Reduce Voltage Autotransformer Starter
- RVRT Reduce Voltage Reactor Transformer
- Synchronous, brush or brushless starter
- Medium power capacitor banks
- Available arc resistance construction in model 2
- Available options:
  - Transition sections for close coupling to switchgear
  - Auxiliary section for larger cable entry applications
  - PT draw-out compartment

# Product Applications

- Induction/Synchronous medium and large motors
  - Blowers, Fans, Conveyors, Pumps, Compressors, Expanders/extruders



## LOAD DATA - HORSEPOWER RATINGS

<i>Application</i>	<i>Load Data</i>							
<i>Contactor Rating (A)</i>	<i>400</i>				<i>720</i>			
<i>Voltage Rating (kV)</i>	<i>2.2-2.5</i>	<i>3.0-3.3</i>	<i>4.0-5.0</i>	<i>6.0-6.6</i>	<i>2.2-2.5</i>	<i>3.0-3.3</i>	<i>4.0-5.0</i>	<i>6.0-6.6</i>
Motors								
Squirrel-Cage Motor	1,750	2,250	3,000	4,500	2,500	3,000	4,500	6,000
Synchronous Motor (0.8 PF)	1,750	2,250	3,000	4,500	2,500	3,000	4,500	6,000
Synchronous Motor (1.0 PF)	2,000	2,500	3,500	5,000	3,000	3,500	5,000	7,000
Other								
Transformer (kVA)	1,500	2,000	3,000	4,000	2,500	3,500	4,500	7,000
Capacitor (kVAR)	1,500	2,000	2,000	2,000	2,000	2,000	2,000	2,000



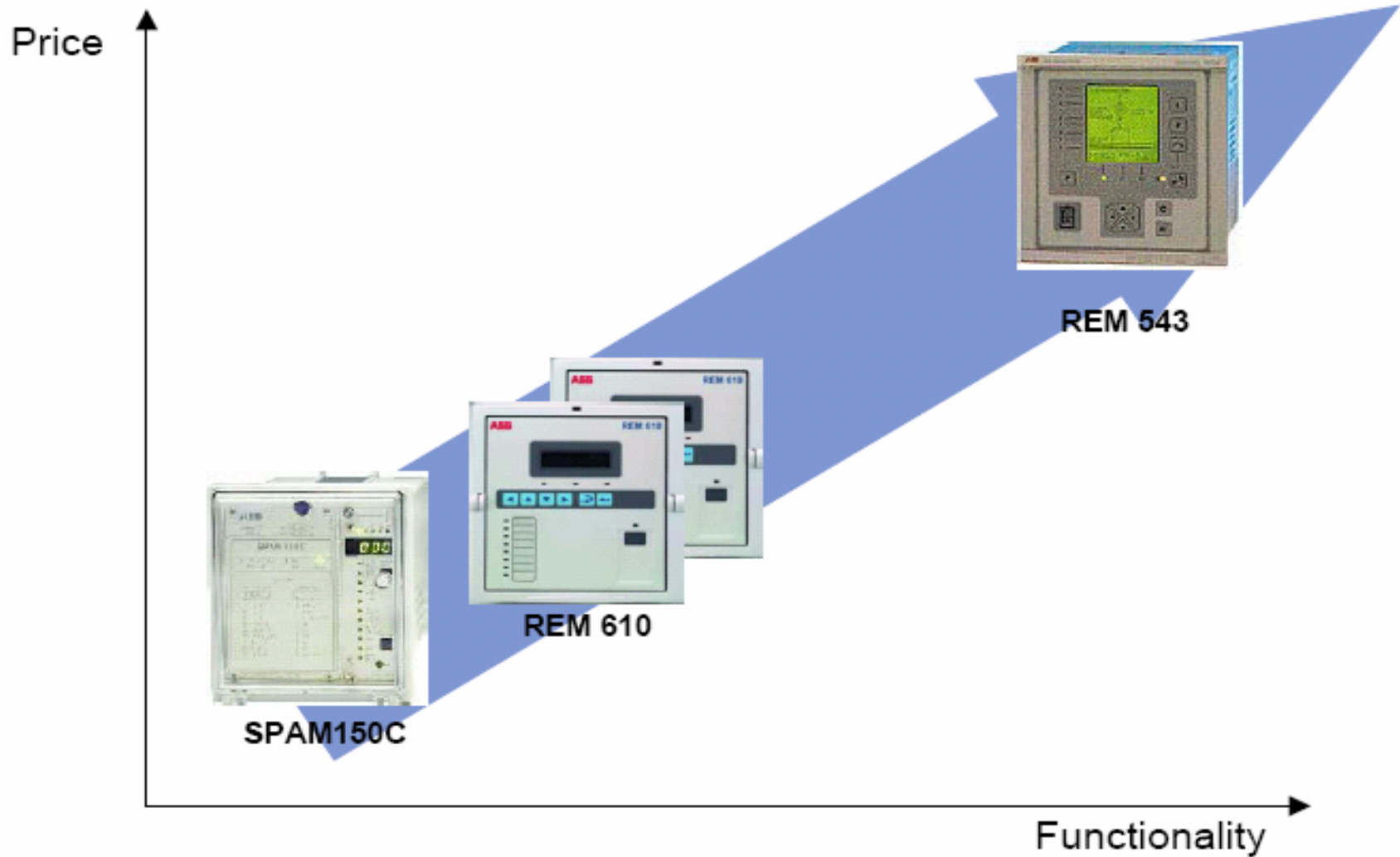
# Product Applications

- Medium Power Transformers
  - Auxiliary services, MV Solid State Drivers/Starters
- Medium Power Capacitor Banks
  - Improve Power Factor

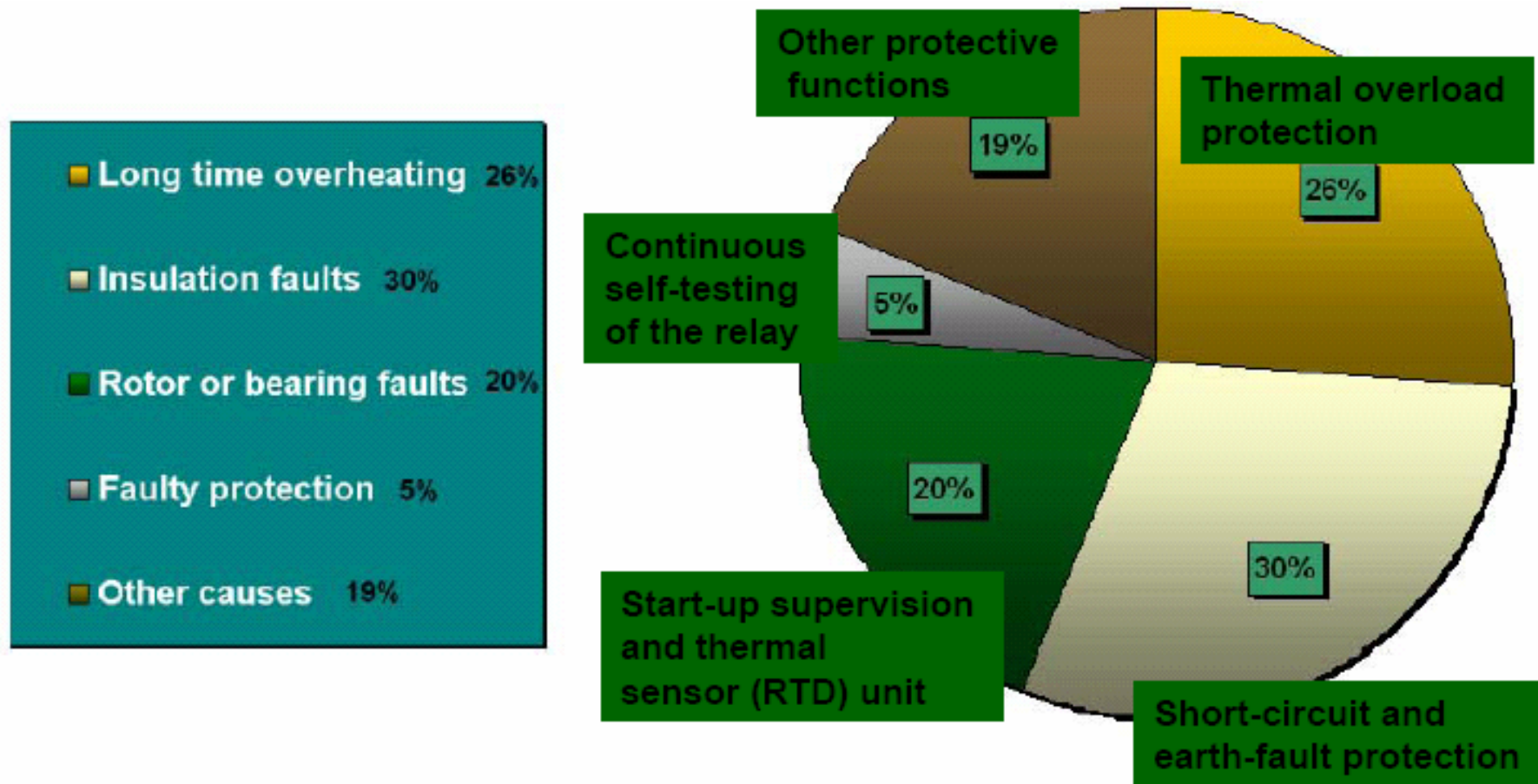


<i><b>System Voltage</b></i>	<i><b>3 Phase Transformer</b></i>	<i><b>3 Phase Capacitor</b></i>
<i><b>2.2-2.5 kV</b></i>	<i><b>1500 kVA</b></i>	<i><b>1500 kVAR</b></i>
<i><b>3.0-3.3 kV</b></i>	<i><b>2000 kVA</b></i>	<i><b>2000 kVAR</b></i>
<i><b>4.0-5.0 kV</b></i>	<i><b>3000 kVA</b></i>	<i><b>2000 kVAR</b></i>
<i><b>6.0-6.6 kV</b></i>	<i><b>4000 kVA</b></i>	<i><b>2000 kVAR</b></i>

# ABB motor protection from basic to high range solutions



## Common causes for motor damage and means of protection





# Motor Protection Relay REM 610



# Motor Protection Relay REM 610

- Protection functions
  - Thermal overload protection (49)
  - Temperature supervision based on RTDs (49/38)
  - Motor startup supervision (48)
  - Cumulative motor start-up time counter (66)
  - Short-circuit protection (50)
  - Overcurrent protection (51)
  - Earth-fault protection (50N/51N)
  - Phase unbalance / phase reversal protection (46)
  - Undercurrent (loss of load) protection (37)
  - Circuit-breaker failure protection (62BF)
  - Electrically latched lockout relay (86)
  - Emergency restart

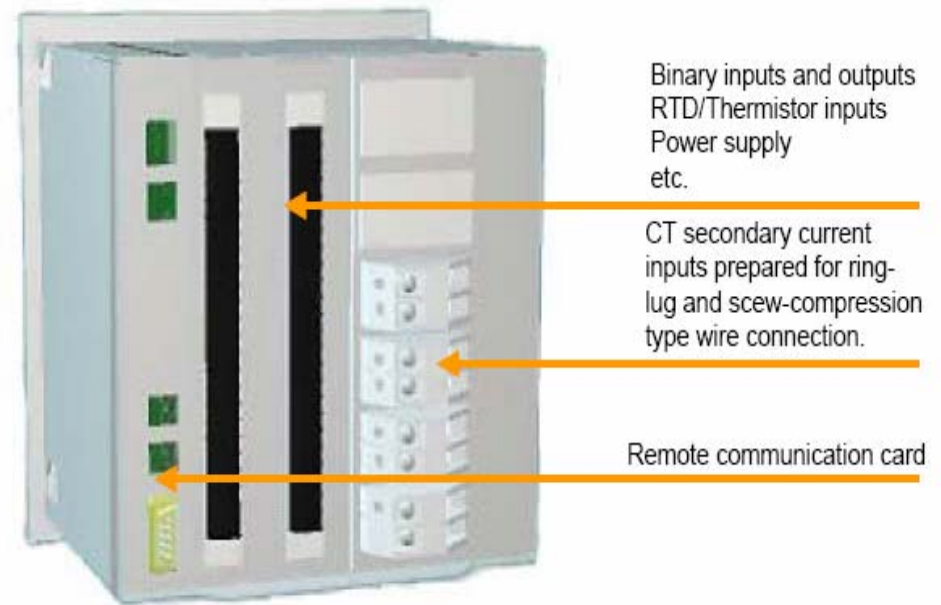
# Motor Protection Relay REM 610

- Measurements & Display
  - Phase & residual current (RMS)
  - Negative phase sequence current
  - Display of measured values in primary units
  - Motor stress during start-up
  - Temperature via RTDs
- Disturbance recorder data (RAM, battery backup)
- Self-supervision and alarms
- Communication Protocols
  - SPA bus communication (via front and rear port )
  - IEC 60870-103-5 communication (via rear port only)
  - Modbus communication (via rear port only)

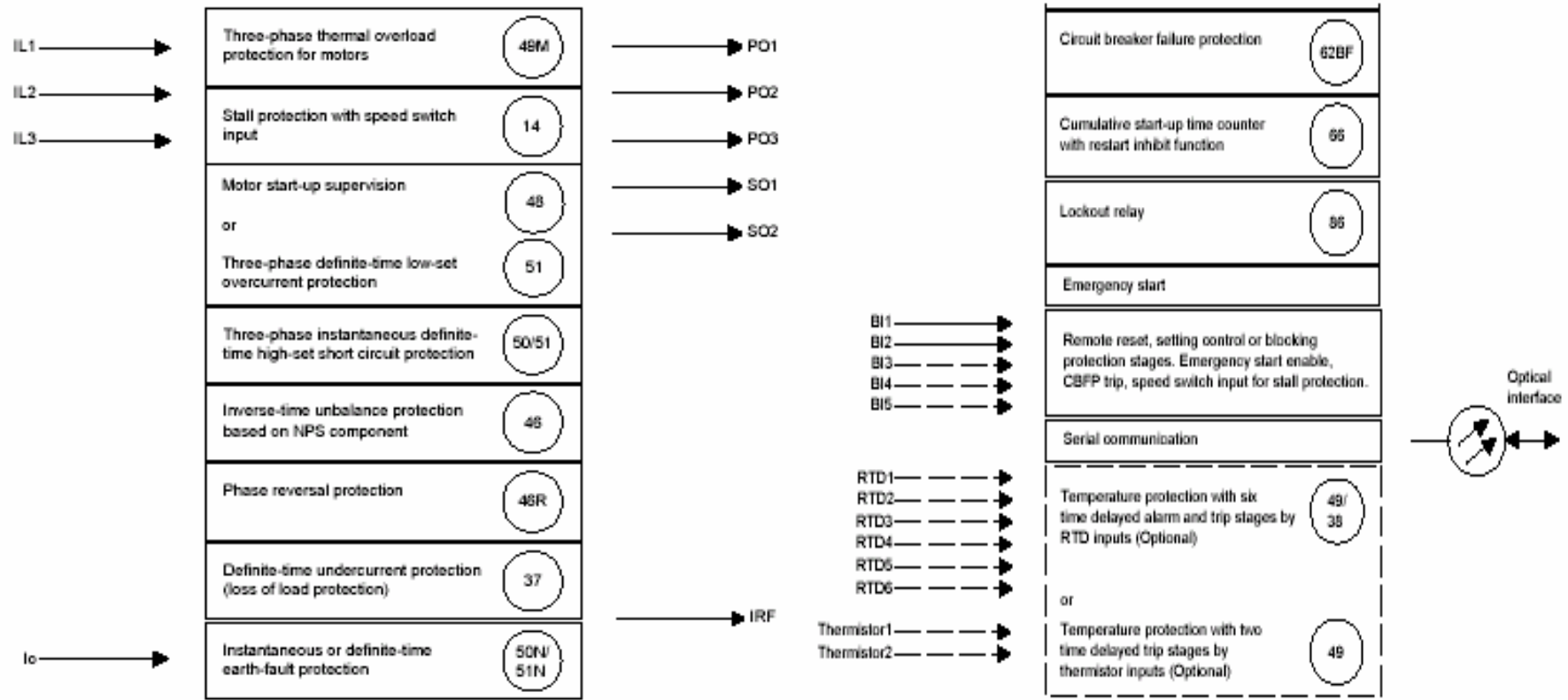
# Motor Protection Relay REM 610

## Withdrawable mechanical design

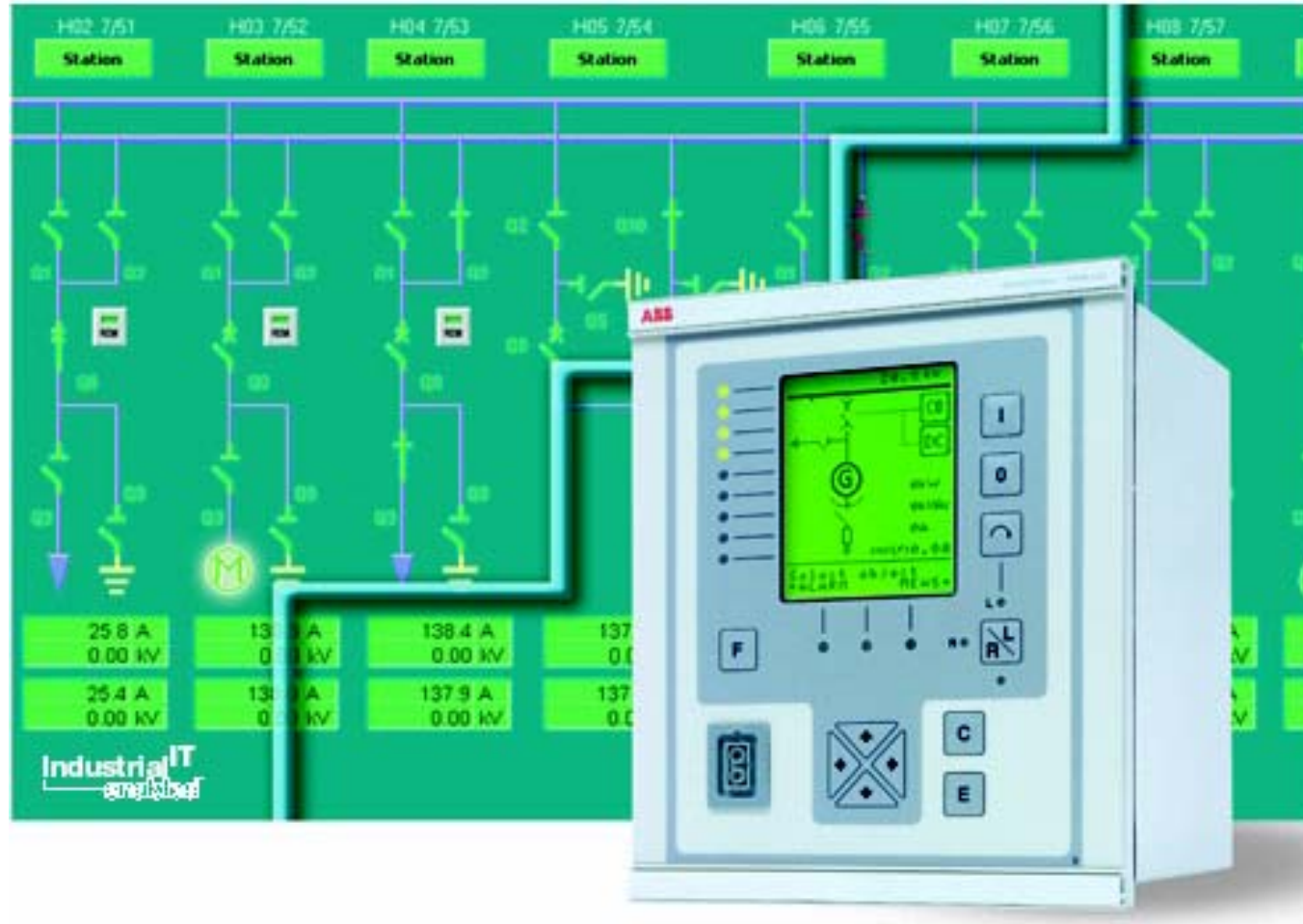
- Easy to install and handle
- Automatic short-circuiting of CT secondaries
- Communication maintained even when relay unit withdrawn
- Mechanical coding for identification of plug-in unit
- Easy mounting - no loose mounting accessories
- Both compression type connection and ring-lug terminal connection of CT secondary wires
- IP 54 degree of protection by enclosure of the relay case when flush-mounted.



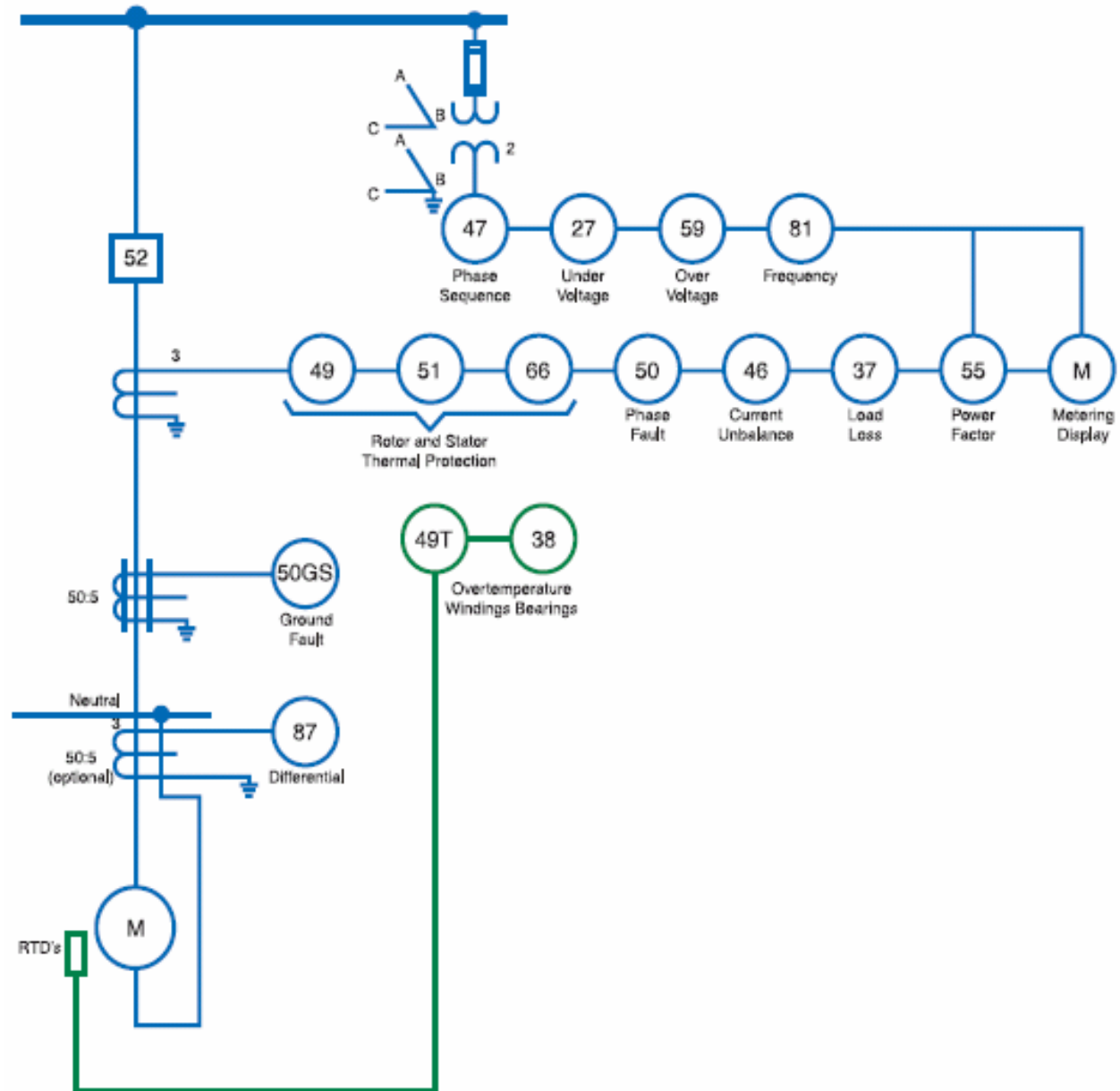
# Motor Protection Relay REM 610



# Motor Protection Relay REM 543



# Motor Protection Relay REM 543



# Motor Protection Relay REM 543

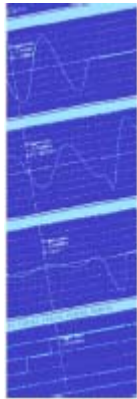
Characteristic	ABB REM 543
Multifunction Motor Protection	Yes
<b>Protection Elements</b>	
Undervoltage protection 27	Yes
Undercurrent/load loss 37	Yes
Bearing Overtemperature (RTD) 38	Yes (see note 1)
Negative Sequence overcurrent 46	Yes
Phase Sequence (voltage) 47	Yes
Thermal Overload 49	Yes
Exponential cooldown/block start	Yes
Overtemperature 49T (RTD)	Yes (see note 1)
Phase Short circuit protection 50	Yes
Ground Fault protection 50N/ 50GS	Yes
Locked Rotor protection 51	Yes
with Starts per Hour limit 66	Yes
mechanical jam/stall	No
Overvoltage protection 59	Yes
Under/Over Frequency 81	Yes
Flux balance differential 87	Yes
For synchronous motors: Loss of Field/Out of Step 55	Yes
Breaker Failure 62BF	Yes
<b>Control Elements</b>	
Accepts speed switch input	Yes
Block Start Output Contact	Yes
Emergency Restart Contact Input	Yes
Trip / Close control from front panel with select before operate sequence	Yes
<b>Motor Feeder Monitoring</b>	
MMI	Large graphical LCD screen, 19 rows
LED status and operation indicators	Many to signal various functions
Metering +/- 0.5% current and voltage +/- 1.0% watts and vars.	Current, Voltage, Watts, Vars, VA, PF, Hz, W-Hr Var-Hr.

Characteristic	ABB REM 543
<b>Communications</b>	
PC communication (front port)	Yes - optical RS232
Modbus Communications Protocol (rear port)	Yes - RS232
<b>Condition Monitoring</b>	
Trip Coil Supervision	Yes
Circuit Breaker condition monitoring & status indication	Yes
Condition monitoring for loss of vt or ct input signals	Yes
Self Diagnostics Alarm Output Contact	Yes
<b>Ratings</b>	
CT inputs	Dual rated: 1A and 5A
PT inputs	100/110/115/120Vac
Control Voltage	110/120/220/240Vac, 110/125/220/250Vdc; or 24-60 Vdc
Control Power Consumption	40W maximum
Service temperature	-20 to +60 degrees C
<b>Standards and Construction</b>	
Protective Relay Standards	IEC 255, ANSI C37.90
UL recognition	In Progress
ISO 9001	Yes
Flush or Semi-Flush mounting case	Yes
Panel Cutout Dimensions	10.0 h x 8.3 w inches
Overall Depth Behind Panel	9.0 inches
Drawout Construction	No
Rear Terminals	Phoenix type
Protective Function Libraries	Pre-Configured models, but possibility of additional functionality in REM543 library. For example, 21 element for high inertia motors.
Digital Contact Inputs	(8 of 11) preconfigured
High Capacity Output Contacts	(5) preconfigured
Lower Capacity Alarm Contacts	(8) preconfigured





# Motor Protection Relay REM 543



- Metering Features:
  - Volts Ph-Ph, Ph-N, Max
  - Current I ph, average, Max
  - Power, Energy, Hz
- Wave capture
- User programable LEDs
- Built In control switches.  
Start/Stop, L0R,  
Forward/Reverse
- Mimic Display
- Comunicaciones
  - SPA, LON, ModBus  
RTU/ASCII, Profibus



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