MNS *i*S Motor Control Center
System Setup and Operation Quick Guide
System Release V6.0

Power and productivity
for a better world™

Technical descriptions relate to System Release 6.0.

MNS *i*S

System Setup and Operation

Quick Guide

System Release 6.0/0

Content

1 MNS *i*S Design & Components

1.1 Switchboard Construction

MNS *i*S as part of the ABB Low Voltage Switchgear solution uses the well proven ABB MNS standard design aspects. MNS aspects described in this section are fully applicable to MNS *i*S.

MNS system is a verified design in accordance with IEC61439-1/-2.

The consistent application of the modular principle both in electrical and mechanical design as well as the use of standardized components allows its flexible and compact design.

Depending on operating and environmental conditions different design levels are offered.

Notable system advantages with regard to design aspects:

- Compact, space-saving design
- Easy project and detail engineering through standardised components
- Verified design acc. IEC 61439-1/-2
- Earthquake-, vibration- and shock-proof designs are available
- Easy retrofitting without the need for switchgear de-energizing
- Maintenance-free busbar construction
- High operational reliability and availability
- Optimum personal protection

1.1.1 Functional separation

The switchboard is divided into vertical and horizontal compartments thus separating different functional areas.

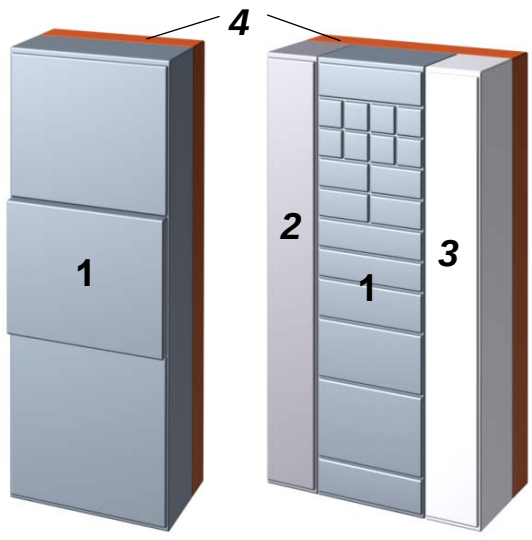


Figure 1 Functional areas: Incomer and MCC

As even power cabling and control wiring are strictly separated within MNS *i*S, the switchboard is structured as follows:

1. Equipment compartment
All equipment, including the standard motor starter modules M*Start* or feeder modules M*Feed* in withdrawable design, is situated therein. The compartment can be divided in horizontal and vertical sub compartments.

2. Control cable compartment
Contains the integrated control devices M*Control*, control cables and terminals.

3. Power cable compartment
Contains power cables and connection units.

4. Busbar compartment
Contains the MNS main busbar system and distribution bars. The distribution bars are embedded in the Multifunction Separation Wall (MFW) which is located between the Equipment compartment and the Busbar compartment

1.1.2 Cable Compartments

Access to integrated components such as electronic protection relays on standard switchgear is usually not possible if the module is energized.

As an outstanding attribute MNS *i*S switchgear provides separate compartments, one for power cables on the right hand and another for control cables on the left hand. The two cable compartments can be provided with different key locks in order to assure specific access rights.

MNS *iS* motor/feeder cables are housed in their own power cable compartment completely isolated from any control equipment or wiring. The cubicle arrangements are configured suitable for front cable access.

The power cable compartment can be provided with cable entry from the top or bottom of the cubicle.

The control cables have their own control cable compartment completely segregated from the power compartments.

This control compartment also houses the integrated motor control units M*Control* and other associated control equipment.

The control wiring can enter from the top or bottom as required for the project. External signals (such as pushbuttons, indicators etc.) connect directly to the M*Control* main board.

Figure 2 MNS *i*S switchboard with control cable compartment (left side) and power cable compartment (right side)

1.2 Withdrawable Module Design

M*Start* and M*Feed* modules of withdrawable design provide a maximum of plant and operator safety.

As per definition in IEC 61439-1/-2 withdrawable modules can be electrically disconnected (“withdrawn”) without the help of a specific tool with respect to the main incoming circuit, the main outgoing circuit as well as the auxiliary circuits.

M*Start* and M*Feed* are standardized components, ready-to-use and offered for a wide application range leading to maximum flexibility.

The high device packing density allows a comparatively low footprint of the MCC.

Figure 3 M*Start* modules in MNS *i*S switchboard

1.2.1 Main Characteristics

- Multi-functional operating handle connecting to module interlocking mechanism (see page 52)
- Ergonomic module handle to withdraw the module
- Status display (4 LED) integrated in module front
- Module rear wall with integrated contact system and sensors
- Control terminal block

M*Start* and M*Feed* comprise the power circuit and measurement functionality, thus they are decoupled from integrated control.

Integrated control and protection functionality is performed by the allocated M*Control* located in the control cable compartment.

Utilisation of conventional feeder modules for energy distribution is possible for conventional control instead of M*Control* functionality.

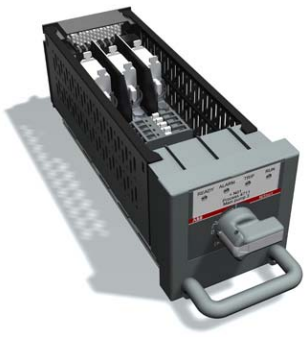


Figure 4 M*Start* size 6E/4

Figure 5 M*Start* size 6E/2

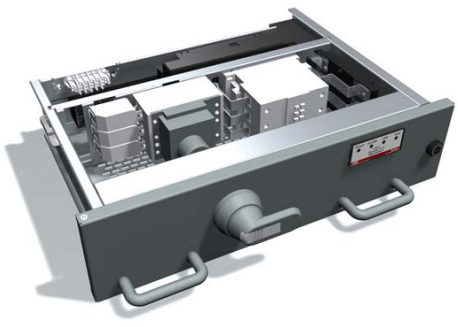
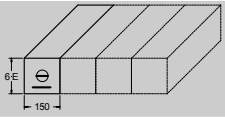
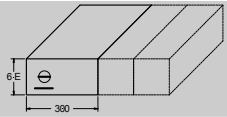
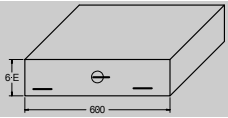
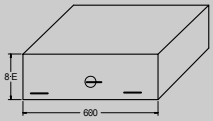
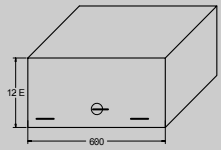
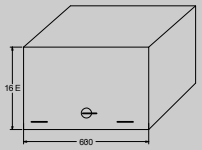
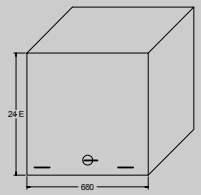


Figure 6 M*Start* size 6E

1.2.2 Dimensions

6E/4 height 150mm; width 150mm	**6E/2** height 150mm; width 300mm	**6E** height 150mm; width 600mm	
			
8E height 200mm; width 600mm	**12E** height 300mm; width 600mm	**16E** height 400mm; width 600mm	**24E** height 600mm; width 600mm
			

1.3 Fixed Module Design

For specific applications M*Start* is offered in fixed design. The module size is 85E (full height of the switchboard).

Fixed modules are utilised for motor starting solutions where a rating in excess of 250kW is required for DOL starting and 160kW for Star Delta.

The motor starter components such as the switching device, contactor and shunt modules are mounted in the main compartment.

The M*Control* and field I/O connections are located either in the upper compartment or lower compartment, dependant upon the cable entry requirements. For example, when cable entry is from below the M*Control* is located in the upper compartment and vice versa.

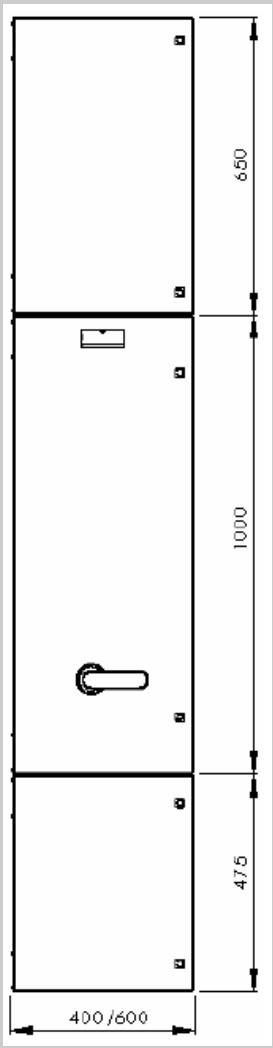
Figure 7 M*Start* modules in MNS *i*S switchboard

1.3.1 Main Characteristics

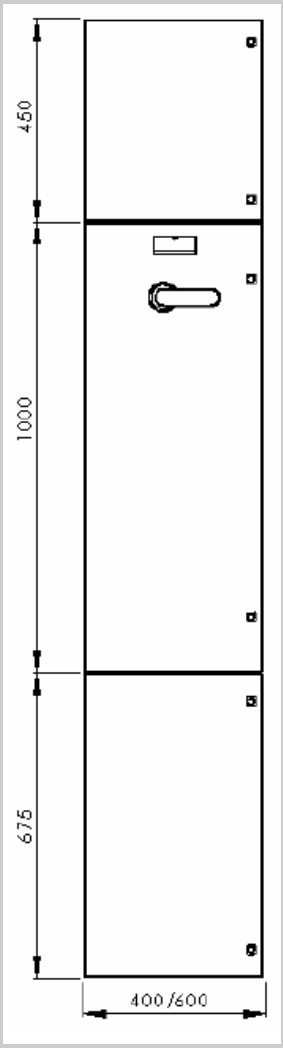
- Multi-functional operating handle connecting to module interlocking mechanism with 3 module positions (ON, OFF, Test), see page 53.
- Status display (4 LED) integrated in front door
- Cable mounting supports for top or bottom entry.
- Direct connection to main busbar

1.3.2 Dimensions

85E – Cable entry from top
Height 2125mm
Width 400/600mm
Depth 600/800/1000mm

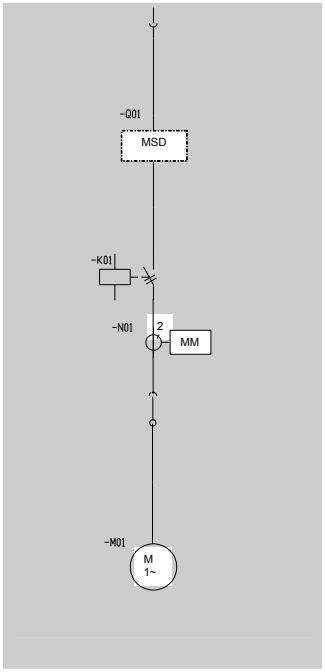
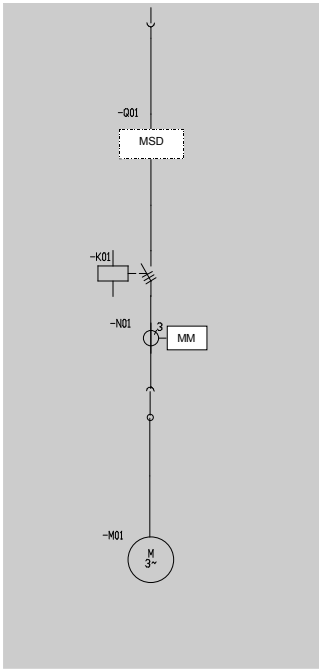
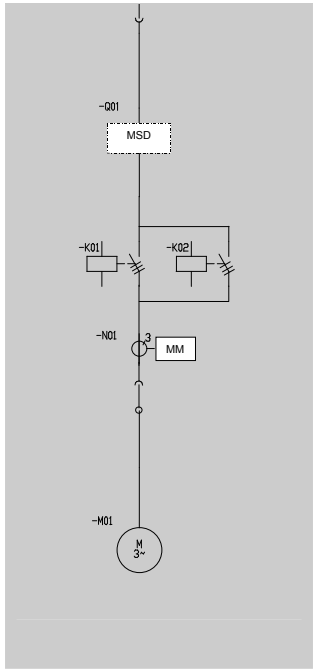
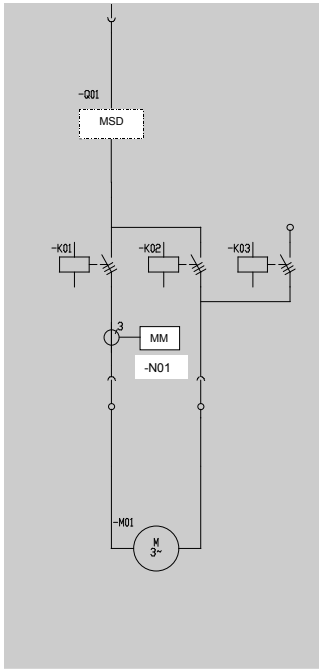


85E – Cable entry from bottom
Height 2125mm
Width 400/600mm
Depth 600/800/1000mm

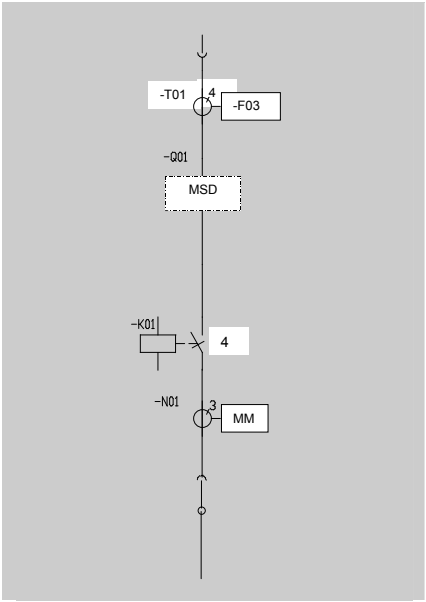
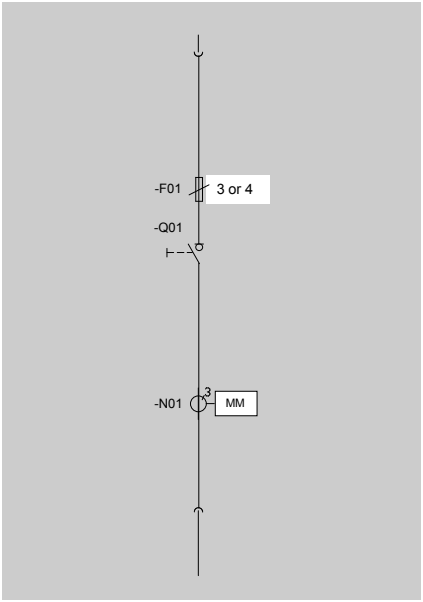
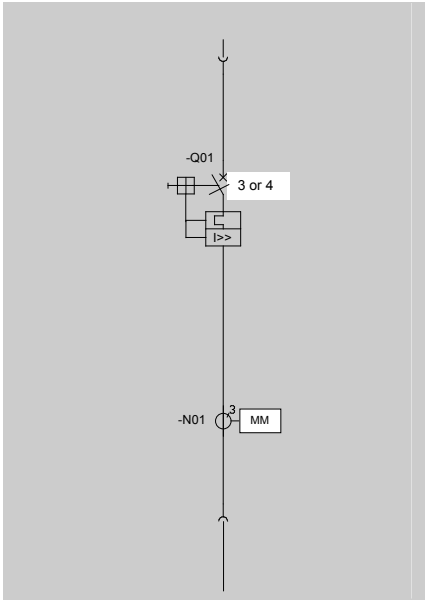


1.4 Module Type Samples M*Start*/ M*Feed*

Motor Starters M*Start*

NR-DOL **Direct Online starters, single phase**	**NR-DOL, HD** **Direct Online starters, Heavy-duty starters** **3 phase**	**REV-DOL** **Reversing starters** **3 phase** (not available in Fixed Design)	**NR-SD** **Star/Delta starters** **3 phase**
			

Contactor Feeders and Energy Distribution Modules M*Feed* (not available in Fixed design)

Contactor Feeder	**Energy Distribution**	
		

Abbreviations:
MM = Measuring module (option for Energy Distribution)
MSD = Main switching device (Fused or Fuseless)

1.5 Power Contact

The precision engineered power contact type 101 is characterized by a turn-able bearing, thus uncoupling cable and contact. Consequently any occurring bending forces can-not affect the stability of the contact.

The mechanical stabilisation is taken over by the supporting plate whereas the contact fingers ensure positive electrical contact. Contact fingers are silver plated.

The contact design has been verified and exceeds the requirements of IEC 61439-1/-2.

Tests:

- Design verified acc. IEC 61439-1/-2
- Corrosion test acc. DIN 50017 and IEC 60068-2-60
- Crimping quality check acc. IEC 61238-1
- Vibration and shock test acc. IEC 60068-2-6 and IEC 60068-2-27

Further on during manufacturing each single contact is subject to a particular routine test screening its function and contact force.

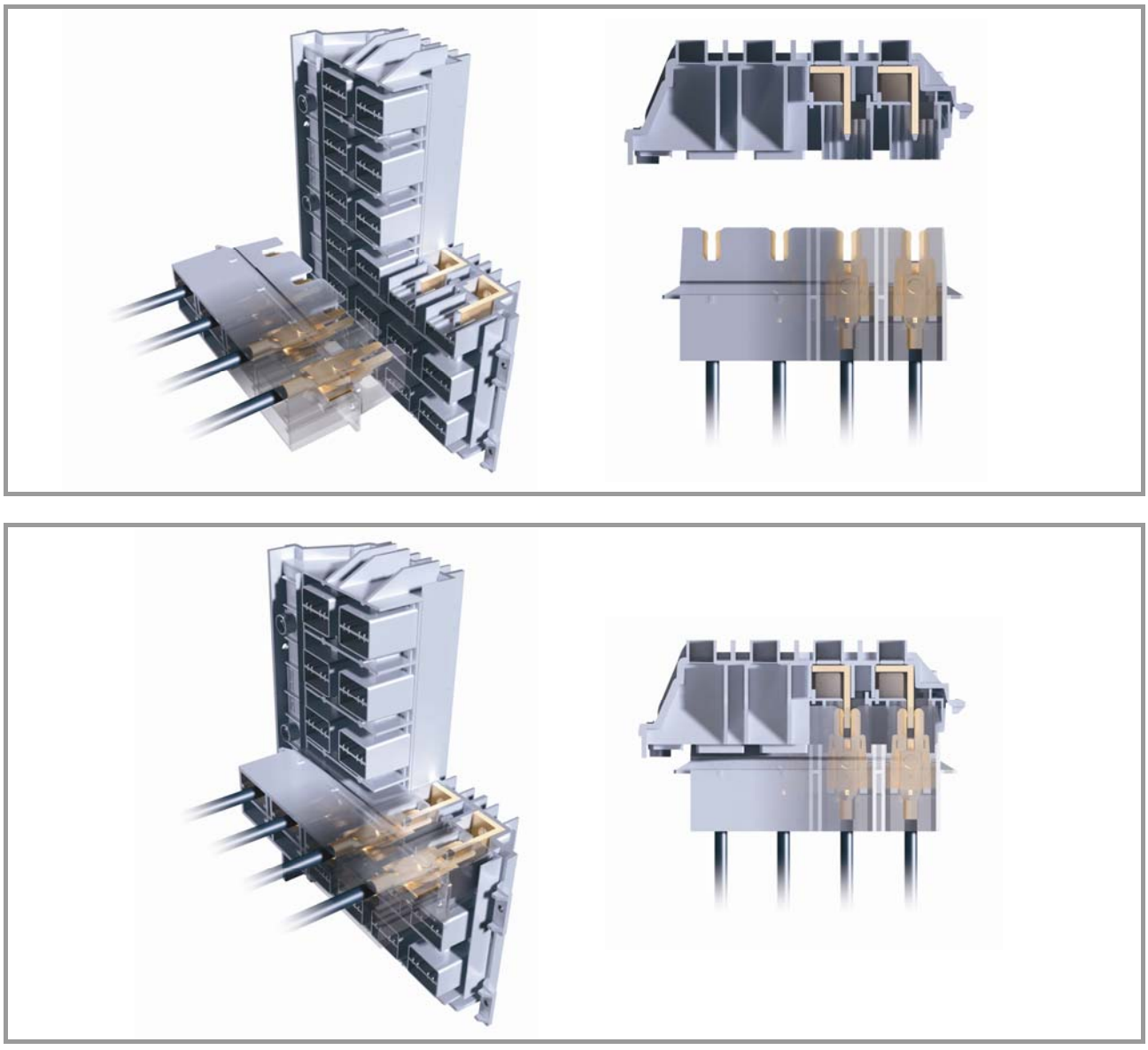


Figure 8 Withdrawable module contacts

1.6 Components overview

1.6.1 MNS *i*S components

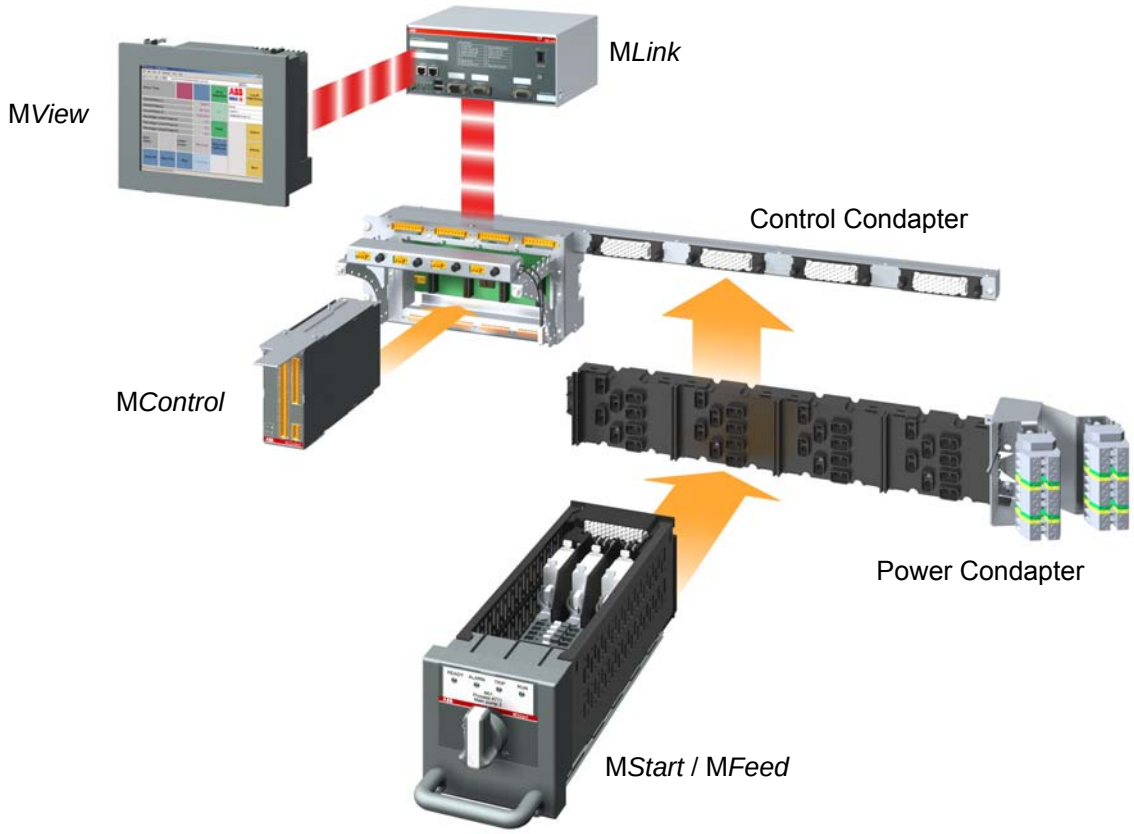


Figure 9 MNS *i*S components

The power module **M*Start* / M*Feed*** comprises:

- the electrical isolator
- the short circuit protection (fuses or circuit breaker)
- contactor and any electrical control equipment and status indication.
- the sensor module (measuring the electrical values, which are made available to the process via the M*Control* processor module.

The integrated motor controller module **M*Control*** (located in the control compartment) comprises:

- the processor performing all the protection, control functions and monitoring functions. It sends and receives information to and from the M*Start* / M*Feed* via an internal bus.
- I/O interface modules providing an interface to external components for both control and indication.

The interface module MLink serves for the serial gateway interface to higher level systems which communicate through the internal bus to all MControl modules.

A local Human System Interface MView is available to monitor the MNS iS status and display information for each connected motor / feeder.

1.6.2 Power Modules M*Start* / M*Feed*

The withdrawable M*Start* / M*Feed* modules are available in the sizes from 6E/4 to 24E depending on the kW rating of the connected motor / load. For module dimensions and selection tables, please see page 9.

A combination of high precision shunt and micro-processor forms a complete measuring system, which does not only measure current very precisely, but at the same time measures the voltage and contact temperature.

*Specific characteristics of Fixed MStart modules see page 10

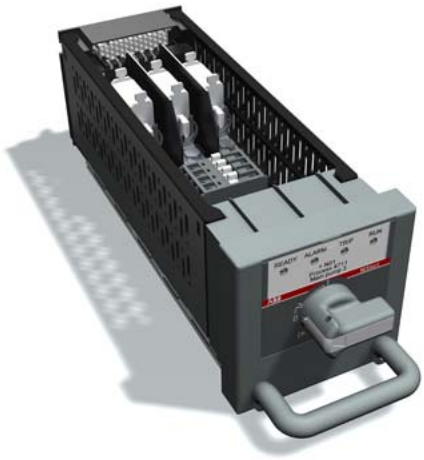


Figure 10 M*Start* module size 6E/4

1.6.3 Conventional Feeder Modules

Feeder modules with module sizes described on page 9, are also available for conventional solutions, ready to be integrated into MNS *i*S switchgear.

Utilisation of this option enables more cost effective solutions for energy distribution applications, where integrated solutions are not required.

Connection details see section

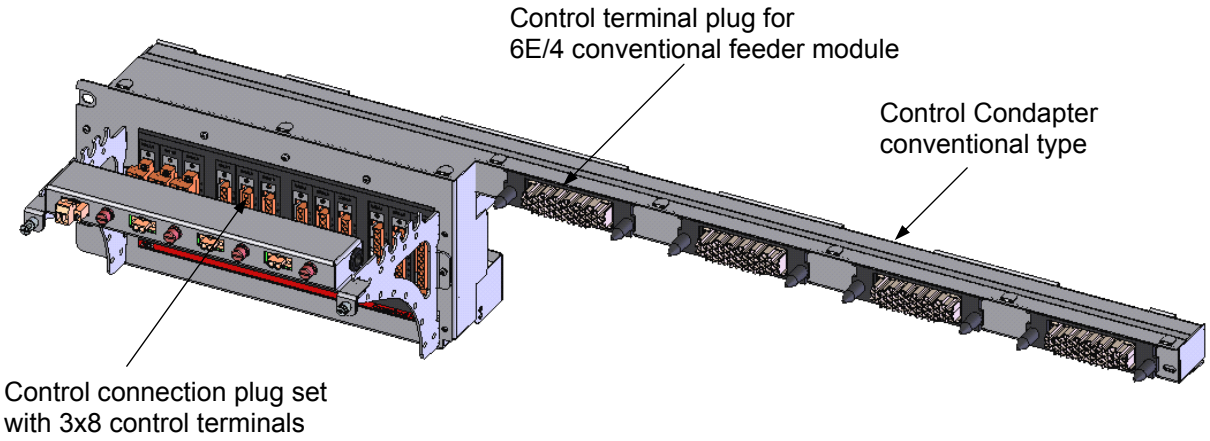


Figure 11 Control Condapter for conventional feeders

1.6.4 Integrated Controller Module M*Control*

The M*Control* is a powerful and modular platform for communication, control, data processing and protection functions. The main control board is based on a microprocessor platform and includes memory for application and process data and a fast communication interface to M*Link* as well as an interface to the M*Start* / M*Feed*.
The module is fully scalable and offers multiple solutions for digital and analogue I/O together with addition relay, measurement and communication cards for specific applications

For description of available interfaces/ connectors, please see section 2.3.

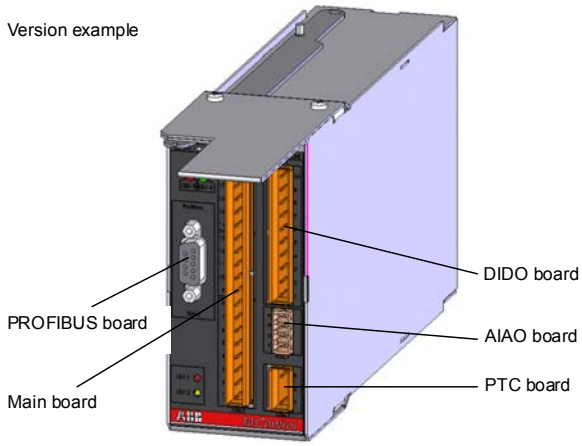


Figure 12 M*Control* module

The M*Control* modules are plugged into separate slots of the control condapter in the control cable compartment. Each slot belongs to a dedicated power module.

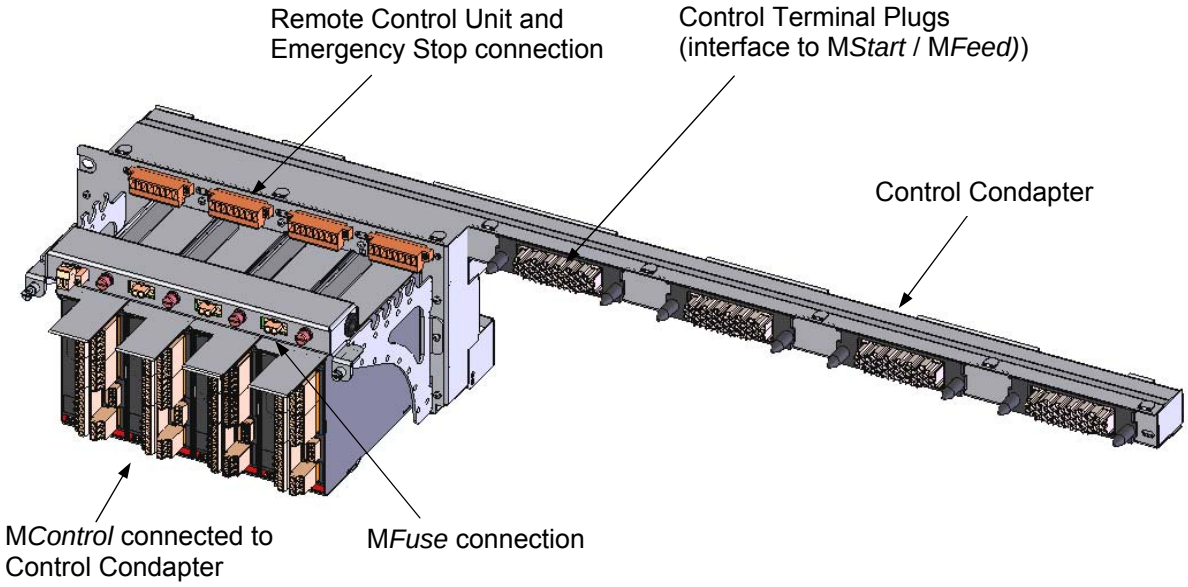


Figure 13 M*Control* connected to Control Condapter

1.6.5 Integration of SACE Circuit Breakers via M*Connect*

M*Connect* serves for MNS *i*S communication to ABB SACE circuit breakers Emax, T7 and X1.

M*Connect* connects to their programmable release units (PR) and supports the following functions:

- Reading of circuit breakers status and measuring values and
- Control of circuit breakers

The following hardware versions are available:

M*Connect* basic version containing the main board with:

- 7DI
- 4 relay outputs

M*Connect* options like:

- 4DI2DO or 7DI board for additional digital signals
- AIAO or 2AI board for analog signals
- and combinations of DIO and AIO cards

Please see MNS *i*S M*Connect* Interface Manual for all available types.

The M*Connect* together with a special type of control condapter is usually mounted in the measuring recess of the circuit breaker cubicle.

Version example

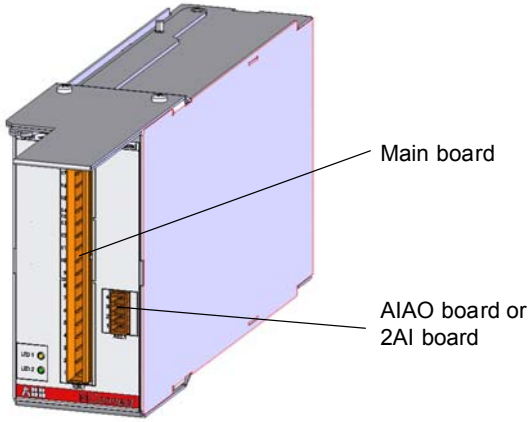


Figure 14 M*Connect* module

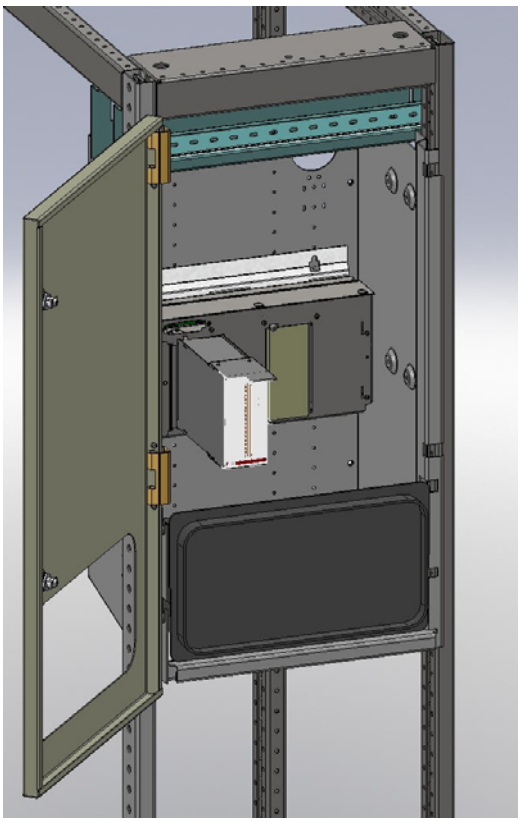


Figure 15 M*Connect* mounted in circuit breaker cubicle (measuring recess)

1.6.6 M*Speed* - Integration of Variable Speed Drives ACS850

M*Speed* stands for the integration of industrial drives (variable speed drives) in MNS *i*S.

M*Speed* is engineered for withdrawable and fixed techniques:

- The withdrawable technique is available up to and includes 45kW for 400V, and 55kW for 500V motors.
- The fixed technique (full height cubicle, without illustration) is designed for motors up to 160kW for 400V, and 200kW for 500V systems.

Available module types are:

- fused and fuseless type 2 coordination for 65kA at 400V / 500V
- fused type 2 coordination for 80kA for 400V / 500V

For the integration into the MNS *i*S communication concept no M*Control* is needed. Instead, M*Speed* is directly connected to fieldbus communication to DCS and accessed via M*View*.

Figure 16 M*Speed* in MNS iS board

Figure 17 M*Speed* mounted in withdrawable M*Start* module

1.6.7 Information Exchange via M*Link*

Information collected through M*Control* and M*Connect* is sent to a communication interface module M*Link* in MNS *i*S.

M*Link* is the communication centre internally to a maximum of 60 M*Control* modules and externally between MNS *i*S and the higher level PLC or Process Control System. The main tasks are gateway functionality and information provider.

As an option, through an Ethernet interface on M*Link*, access to information from and controlling of each M*Control* is available via a web server.

For communication structure, please see section 1.6.10.

Figure 18 MNS iS Communication interface M*Link*

1.6.8 User Interface M*View*

The local Human Machine Interface M*View* can be installed in the switchgear and connected to M*Link* to monitor and operate the system depending on the access rights.

The M*View* is a standard Industrial Panel. Touch screen functionality allows easy operation and navigation through windows. The connection to MNS *i*S is configuration free, all information displayed is received directly from a web server integrated in the M*Link*.

In addition a standard PC, running Web browser software, can be connected directly or through a standard Ethernet network to access the web server in M*Link*.

Figure 19 M*View* in MNS *i*S Switchboard

1.6.9 Parameterization SW Tool M*Navigate*

The Microsoft Windows based software application M*Navigate* can be used to parameterize MNS *i*S from a convenient location outside the switch room environment. The PC is connected via Ethernet network topology to the M*Link* devices in this network.

Capabilities:
- User settings/ Access control
- Parameterization, Configuration and Download
- Diagnostic function
- Archive/ Restoration/ Reports of project data
- Switchgear Arrangement overview
- Guidance by Online help

For details see section 2.9 Project specific parameterization via MNavigate

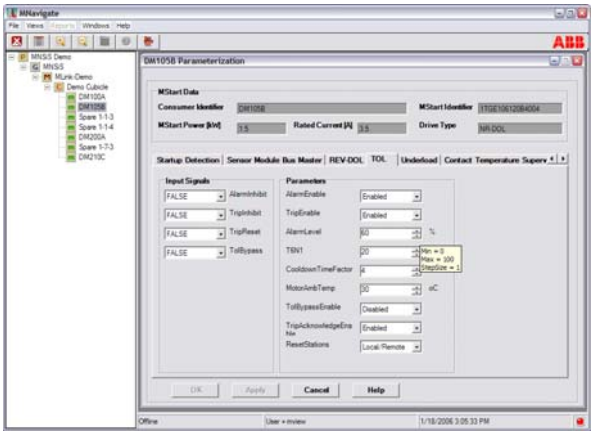


Figure 20 M*Navigate* motor starter parameter screen

1.6.10 Communication Details

The communication between M*Link* and the M*Control* devices internally is a RS485 peer-to-peer communication (max 10MBps) with a deterministic Master-Slave protocol.

Up to 60 M*Control* devices can be connected to one M*Link*. The wiring between all M*Control* and M*Link* Motor Operation via Human Machine Interface (Web Interface) is built-in inside the switchboard, no additional wiring is required. Multiple M*Link* can communicate via fieldbus (Profibus or MODBUS) to the control systems. The M*Link* acts as a standard fieldbus slave device in Master-Slave communication protocols.

As an option, redundancy in communication systems and fieldbus technology allows data communication between a PLC or PCS master to slave devices on two independent communication links. This may be utilized if a higher availability of the communication link is required.

The M*Link* contains time server / client functionality as an option to provide accurate time signal to all M*Control*. The time stamp of alarm and events from M*Control* is distributed to a higher level Process Control System via the Ethernet network.

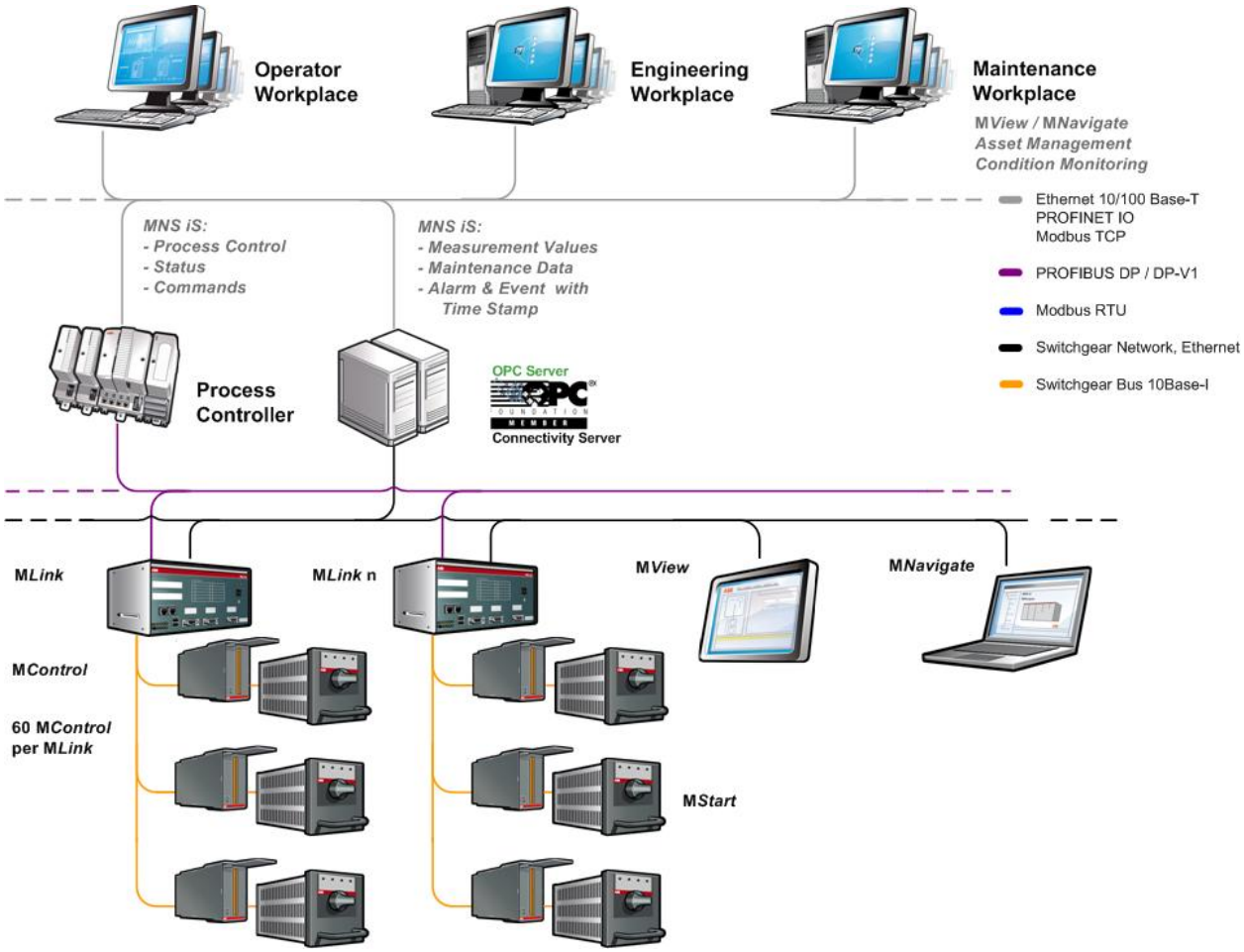


Figure 21 Typical Communications Overview

2 MNS *i*S System Setup

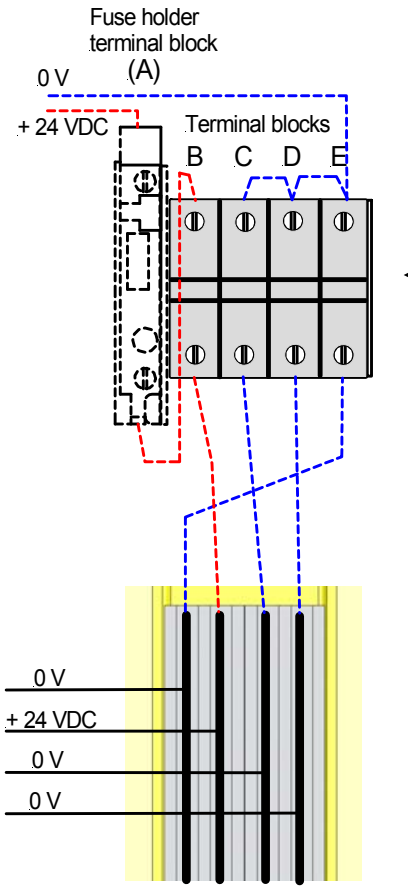
2.1 Cubicle identification

For the MNS *i*S System to operate correctly each cubicle requires an identification number. One M*Link* communicates to a maximum of 7 cubicles. This numbering is defined at the project engineering stage.

Cubicle numbers are accordingly set by defined connections of the terminal blocks to the fuse holder on the top of the 24 V DC Control voltage supply bar.

M*Link* identifies the cubicle based on the live supply bars.

Figure 22 shows exemplarily the coding of cubicle number 1.



Example

Cubicle number	Connection of the terminal blocks		
	B	**C**	**D**
	(Binary code 2^0)	(Binary code 2^1)	(Binary code 2^2)
1	→ **A**	→ **E**	→ **E**
2	→ **E**	→ **A**	→ **E**
3	→ **A**	→ **A**	→ **E**
4	→ **E**	→ **E**	→ **A**
5	→ **A**	→ **E**	→ **A**
6	→ **E**	→ **A**	→ **A**
7	→ **A**	→ **A**	→ **A**

Figure 22 Switchboard identification (example)

2.2 Module location setting

Each single M*Control* as well as M*Start* / M*Feed* module position is defined in the MNS *i*S project configuration data.

As a precondition for the allocation between particular M*Control* and M*Start* / M*Feed* devices the vertical position of the M*Control* in the switchboard has to be set.
The BCD rotary switches used for this setting are located on the backplane of the control condapter, see Figure 19. Both switches indicate the horizontal position of the module top edge as decimal code.

The horizontal positions 1 through 4 on each level are registered automatically with the insertion of the particular M*Control*.

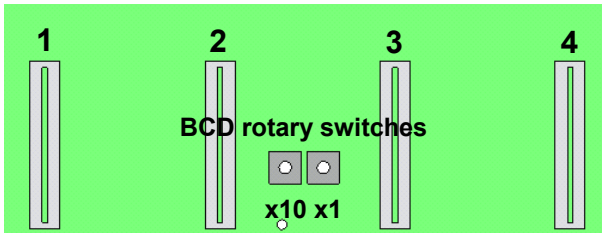


Figure 23 BCD rotary switches on control condapter

BCD rotary switch x 10 Position	BCD rotary switch x 1 Position	Module location (2E steps)
0	1…9	01…09
1	0…9	10…19
2	0…9	20…29
3	0…6	30…36

Sample configuration

BCD rotary switch position x 10	BCD rotary switch position x 1	Horizontal level of module in switchboard (upper edge)	Module height (Sample configuration)	Vertical position of module in compartment (No. of M*Control* main board)
0	1	**1** 2 3	4 x 6E/4	1 / **1** | 1 / **2** | 1 / **3** | 1 / **4**
0	4	**4** 5 6	2 x 6E/2	4 / **1** | 4 / **3**
0	7	**7** 8 9	6E	7 / **1**
1	0	**10** 11 12 13 14 15	12E	10 / **1**
1	6	**16** 17 18 19 20 21 22 23 24	16E	16 / **1**
2	5	**25** 26 27 28 29 30 31 32 33 34 35 36	24E	25 / **1**

2.3 M*Control* Setup

For an introduction to M*Control* functionality see section MNS *i*S Design and Components, page 15.

2.3.1 Interfaces and Indications

The basic component of the M*Control* unit is the main board. It is contained in a metal housing.

The main board is the main processing unit providing

- basic digital I/Os
- switchgear bus interface
- serial connection to M*Start* / M*Feed*
- power supply

If specified, extension cards providing optional functionality are added to the main board:

- Extended Digital I/O
- Extended Analog I/O
- Profibus Direct Interface
- PTC I/O
- Relay cards
- 3-channel PT 100

Extension cards can be used if they are selected with the project specific configuration within the ABB Engineering tool.

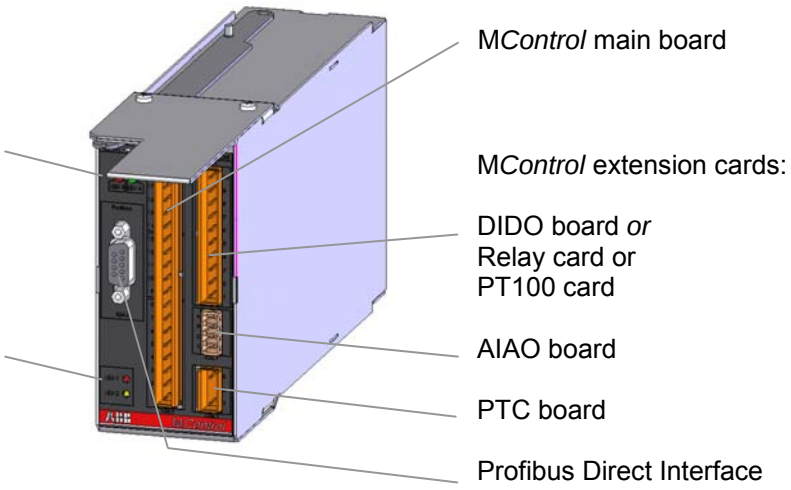


Figure 24 M*Control* components

2.3.2 Connection to Control Condapter

Each M*Control* is plugged into a slot of the control condapter located in the control compartment of the MNS *i*S cubicle (see Figure 25).
The horizontal and vertical position of this slot corresponds with the dedicated power module (M*Start* / M*Feed*) location. After insertion, the M*Control* unit is internally connected (hardwired) to this M*Start* / M*Feed* module.

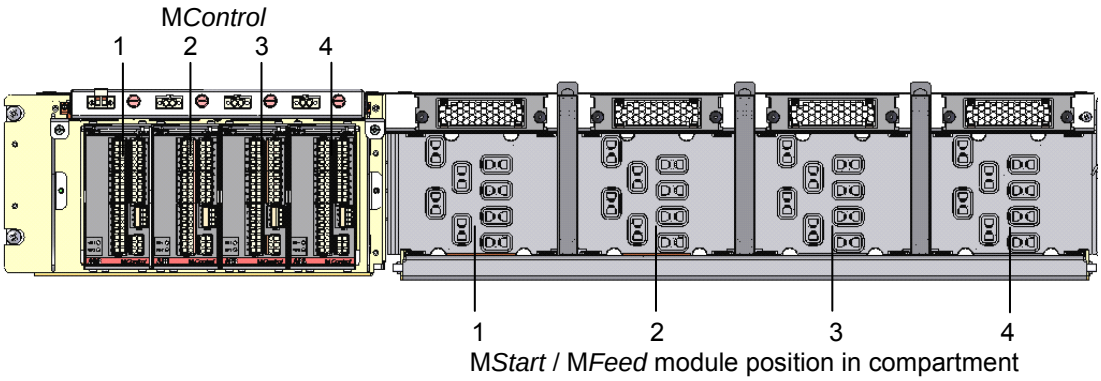


Figure 25 M*Control* location

2.3.3 M*Control* connection

After insertion, the M*Control* is mechanically locked by pivoting the locking lever on the top of the unit.

The connection of M*Control* with the M*Start/* M*Feed* module works as the plug and produce method via the rear connector of the M*Control* unit. The M*Control* front connectors are wired according the project specific pin allocation of I/Os, bus interfaces etc.

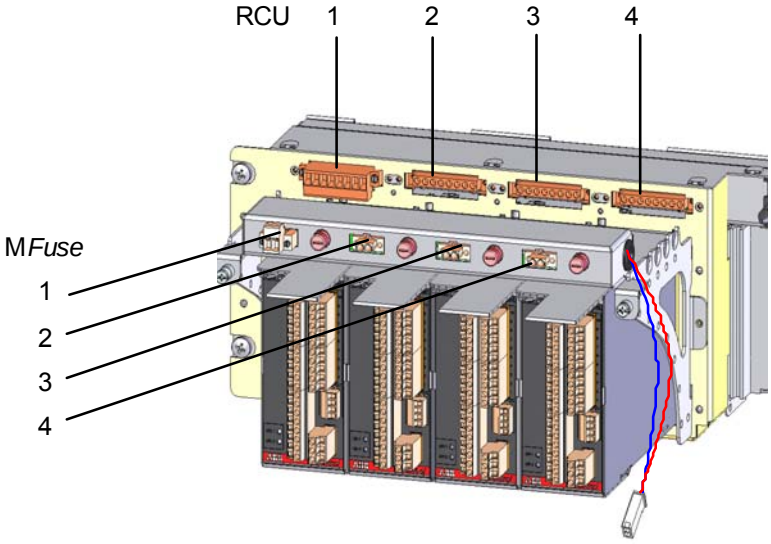


Figure 26 M*Control* connection

Important:
The contactor control circuit for each starter can be opened for the optional use of a Remote Control Unit (RCU) or Emergency Stop at connector X35 (above M*Control*). Connectors X35.1 and X35.4 are to be bridged in case none of these options is used. See connection diagram on page 25.

M*Control* Connection Diagrams

Overview of connectors on the control condapter backplane and the M*Control* unit:

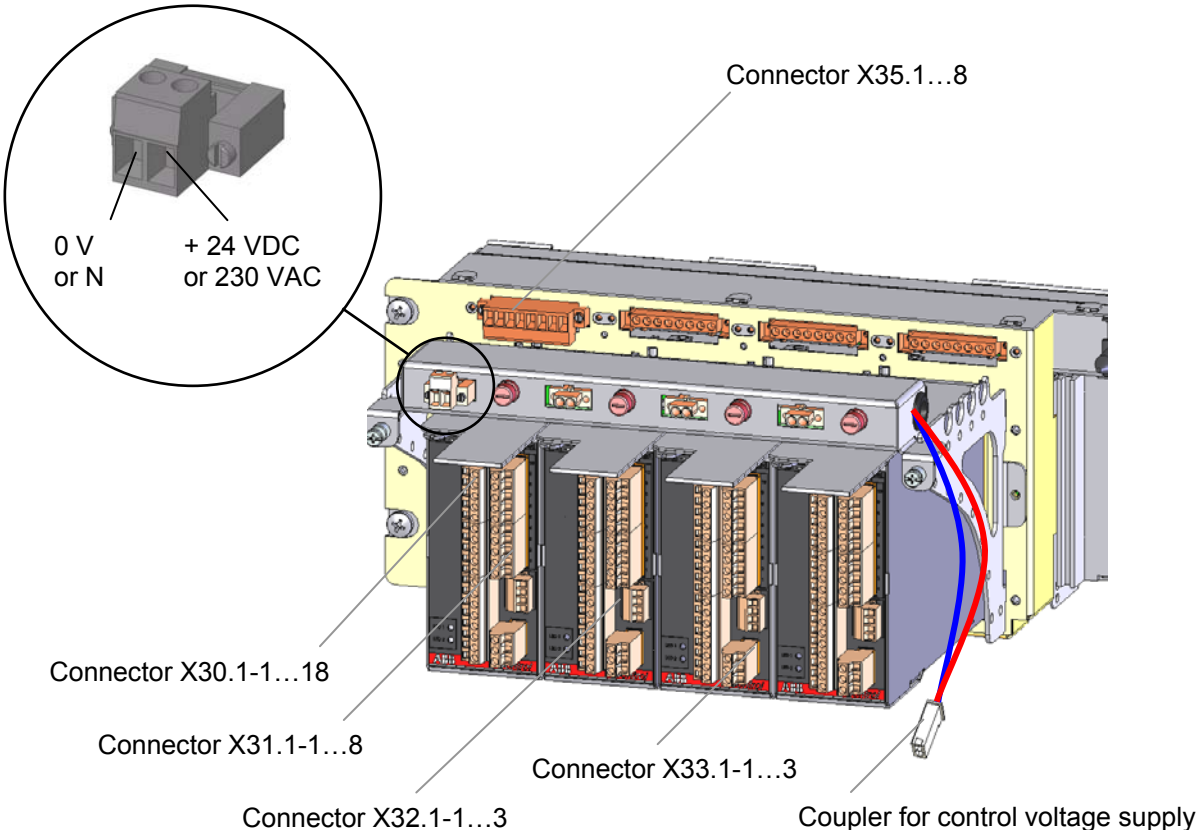


Figure 27 M*Control* connectors overview

For detailed connection diagrams see the following figures. They show the options available for the control and auxiliary circuits. Please refer to the project specific documentation for a more detailed overview.

X35 – RCU / Emergency Stop

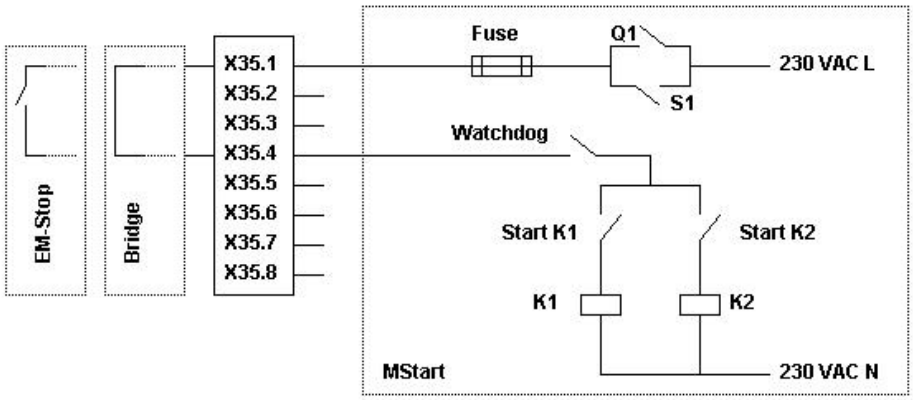


Figure 28 Connection diagram X35

X30 – Main Board

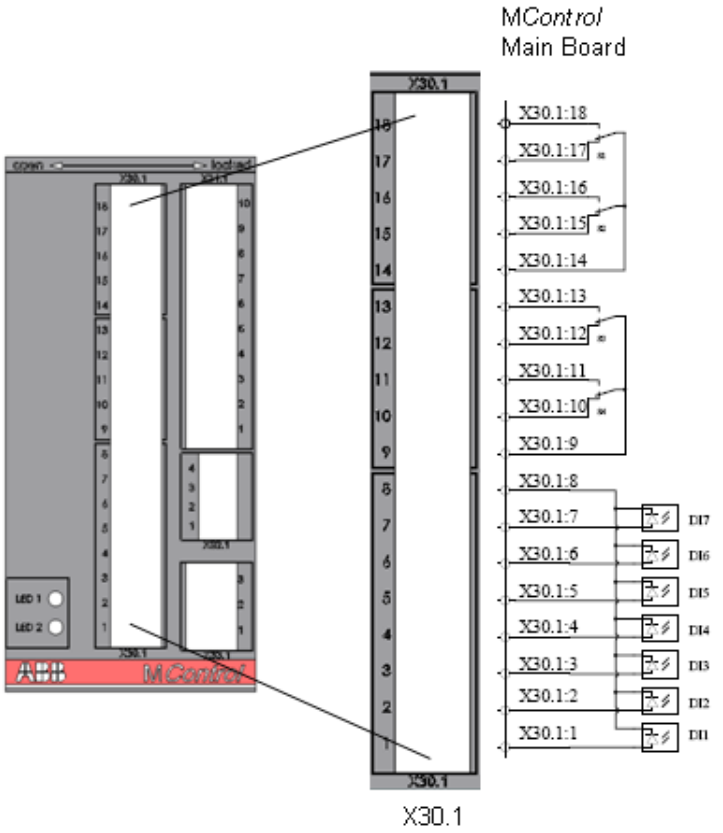


Figure 29 Connection diagram X30 – Main Board

Technical Data

Digital Inputs (24V DC)

Number of digital inputs	7 (DI1…DI7)
Supply for digital inputs	24 V DC
Isolation	Yes
Input signal bounce suppression	Typ. 8 ms
Signal 0 range incl. ripple	-10 … +5 V
Signal 1 range incl. ripple	+16 … +31 V
Input current per channel	(24 V DC) typ. 8.0 mA
Input resistor to 0 V	3 kΩ
Cable length unshielded/shielded	max. 300 m / max. 500 m

Relay Outputs

Number of relay outputs	4 x bi-stable with 2 common roots
Voltage range of contacts	1 – 250 V AC/DC
Lowest switch power for correct signals	0.1 W
Switching capacity per relay contact	AC-15 240 V AC: max. 1.5 A
acc. to EN 60947-5-1 (electromagnetic load)	AC-15 120 V AC: max. 3 A
	DC-13 250 V DC max. 0.1 A
	DC-13 125 V DC max. 0.22 A
Relay contact service life	Mechanical: min $5x10^6$ (at 180 cpm)
	Electrical (250 V AC), at rated load:
	N.O. min. $5x10^4$ / N.C.: min. $3x10^4$ (at 6 cpm)
Internal clearance and creepage distances	> 5.5 mm (safety insulation up to 250 V AC)
relay contacts to 24 V circuits	acc. EN 60947-1, pollution degree 3
Cable length unshielded/shielded	max. 300 m / max. 500 m

X31 – 4DI-2DO board 24 V DC

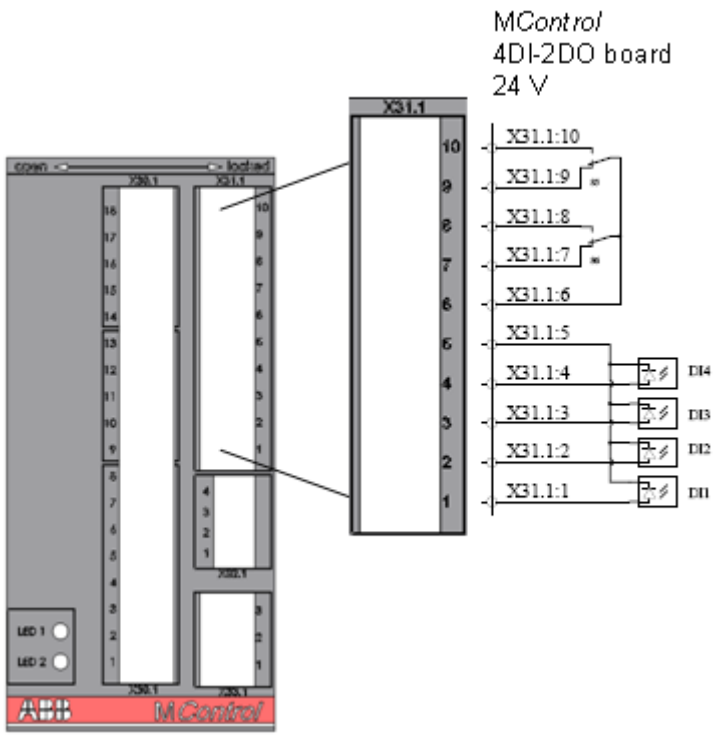


Figure 30 Connection diagram X31 – DI/DO

Technical Data

Digital Inputs (24V DC)

Number of digital inputs	4 (DI1…DI4)
Supply for digital inputs	24 V DC
Isolation	Yes
Input signal bounce suppression	Typ. 8 ms
Signal 0 range incl. ripple	-10 … +5 V
Signal 1 range incl. ripple	+16 … +31 V
Input current per channel	(24 V DC) typ. 8.0 mA
Input resistor to 0 V	3 kΩ
Cable length unshielded/shielded	max. 300 m / max. 500 m

Relay Outputs

Number of relay outputs	2 x bi-stable with 2 common roots
Voltage range of contacts	1 – 250 V AC/DC
Lowest switch power for correct signals	0.1 W
Switching capacity per relay contact	AC-15 240 V AC: max. 1.5 A
acc. to EN 60947-5-1 (electromagnetic load)	AC-15 120 V AC: max. 3 A
	DC-13 250 V DC max. 0.1 A
	DC-13 125 V DC max. 0.22 A
Relay contact service life	Mechanical: min $5x10^6$ (at 180 cpm)
	Electrical (250 V AC), at rated load:
	N.O. min. $5x10^4$ / N.C.: min. $3x10^4$ (at 6 cpm)
Internal clearance and creepage distances	> 5.5 mm (safety insulation up to 250 V AC)
relay contacts to 24 V circuits	acc. EN 60947-1, pollution degree 3
Cable length unshielded/shielded	max. 300 m / max. 500 m

X31 – 4DI-2DO board 230 V AC

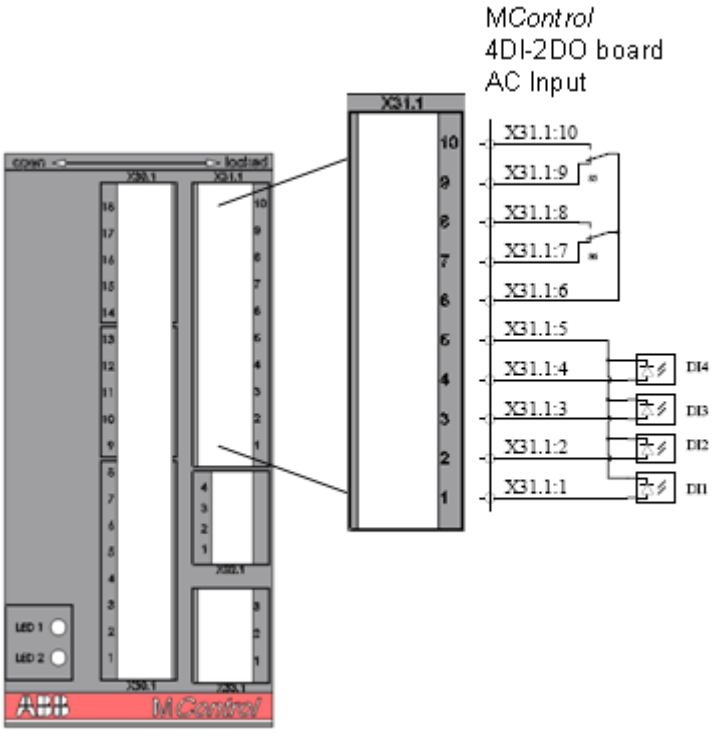


Figure 31 Connection diagram X31 – DI/DO

Technical Data

Digital Inputs (230 V AC)

Number of digital inputs	4 (DI1…DI4)
Supply for digital inputs	110 - 230 V AC or DC
Isolation	Yes
Input signal bounce suppression	Typ. 10 ms
Level class (incl. ripple)	AC 230 V (signal 0: 40 V; signal 1: 159 V) AC 110 V (signal 0: 20 V; signal 1: 74 V) DC 230 V (signal 0: 46 V; signal 1: 175 V) DC 110 V (signal 0: 22 V; signal 1: 79 V)
Input current per channel	(230 V AC) typ. 3.0 mA
Input resistor to 0 V	79 kΩ
Cable length unshielded/shielded	max. 300 m / max. 500 m

Relay Outputs

Number of relay outputs	2 x bi-stable with 2 common roots
Voltage range of contacts	1 – 250 V AC/DC
Lowest switch power for correct signals	0.1 W
Switching capacity per relay contact acc. to EN 60947-5-1 (electromagnetic load)	AC-15 240 V AC: max. 1.5 A AC-15 120 V AC: max. 3 A DC-13 250 V DC max. 0.1 A DC-13 125 V DC max. 0.22 A
Relay contact service life	Mechanical: min $5x10^6$ (at 180 cpm) Electrical (250 V AC), at rated load: N.O. min. $5x10^4$ / N.C.: min. $3x10^4$ (at 6 cpm)
Internal clearance and creepage distances relay contacts to 24 V circuits	> 5.5 mm (safety insulation up to 250 V AC) acc. EN 60947-1, pollution degree 3
Cable length unshielded/shielded	max. 300 m / max. 500 m

X31 – 7DI 230 V AC

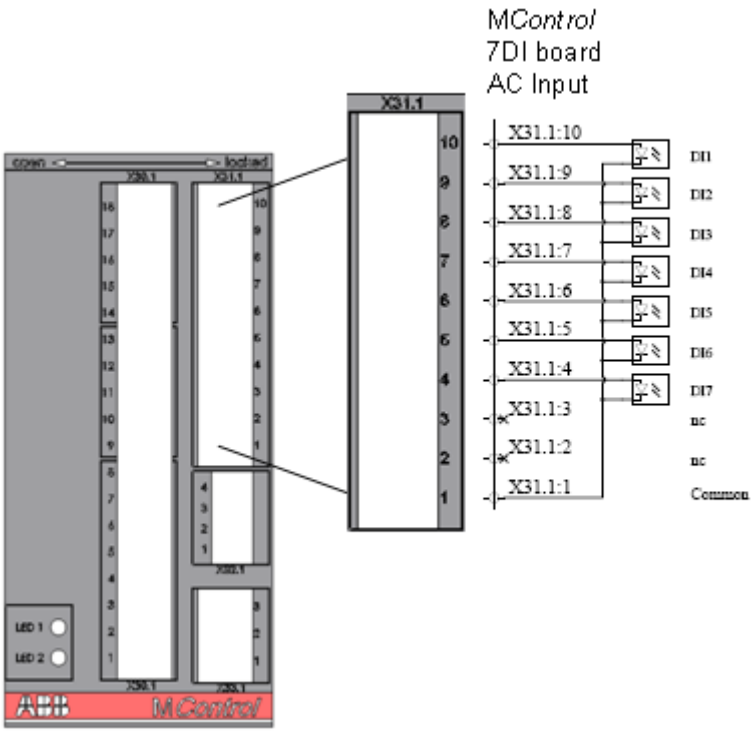


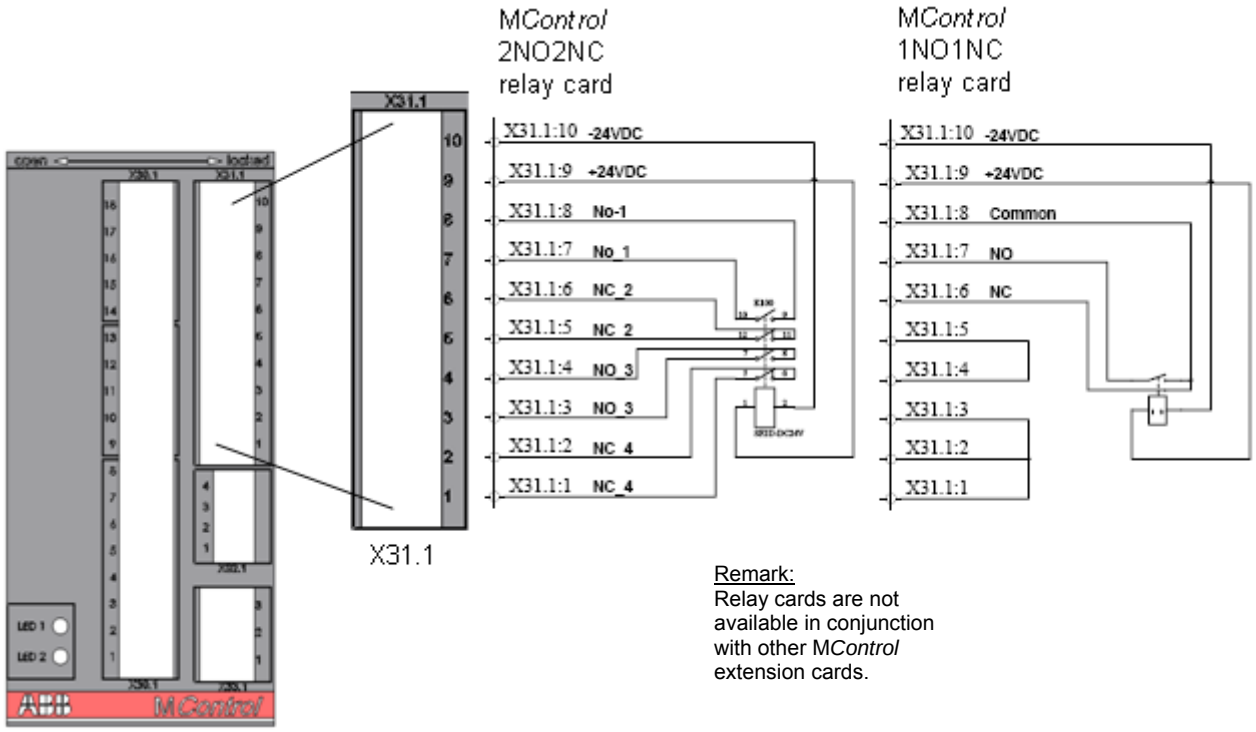
Figure 32 Connection diagram X31 – DI/DO

Technical Data

Digital Inputs (230 V AC)

Number of digital inputs	7 (DI1…DI7)
Supply for digital inputs	110 - 230 V AC or DC
Isolation	Yes
Input signal bounce suppression	Typ. 10 ms
Level class (incl. ripple)	AC 230 V (signal 0: 40 V; signal 1: 159 V) AC 110 V (signal 0: 20 V; signal 1: 74 V) DC 230 V (signal 0: 46 V; signal 1: 175 V) DC 110 V (signal 0: 22 V; signal 1: 79 V)
Input current per channel	(230 V AC) typ. 3.0 mA
Input resistor to 0 V	79 kΩ
Cable length unshielded/shielded	max. 300 m / max. 500 m

X31 – Relay Card



Remark:
Relay cards are not available in conjunction with other M*Control* extension cards.

Figure 33 Connection diagram X31 – Relay card

Technical Data

	2NO2NC	**1NO1NC**
Nominal switching capacity	6 A / 250 V AC 6 A / 30 V DC	8 A / 250 V AC 8 A / 30 V DC
Max. switching voltage	440 V AC 30 V DC	380 V AC 125 V DC
Coil nominal operating power	500 mW	200 mW
Coil nominal voltage		24 V DC
Coil pick-up		18 VDC
Coil drop-off		2.4 V DC

X31 – PT100 board

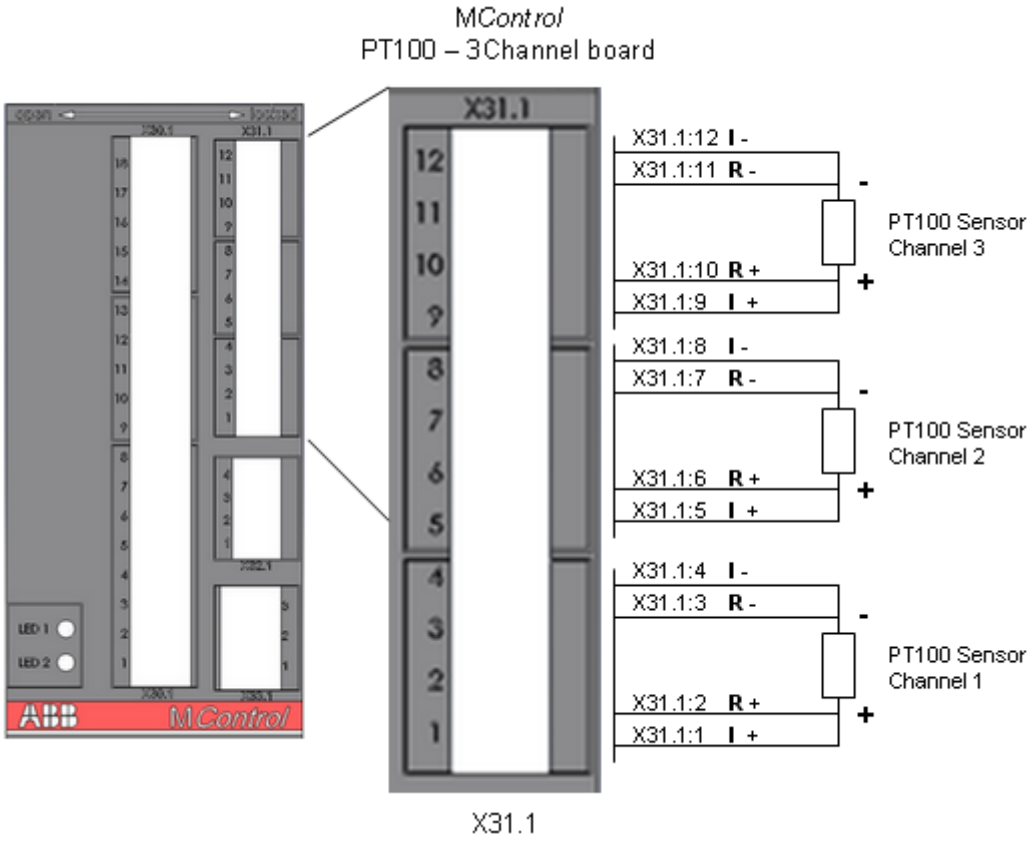


Figure 34 Connection diagram X31 – 3 channel PT100

Technical Data

Broken wire resistance	> 240 Ω
PT 100 range	40 – 240 Ω
Response time	< 200 ms
Line length (shielded)	4 x 300 m (0.5 – 1.5 mm^2)
Isolation	Yes
Accuracy	< 0.1 %
Open loop voltage	3.3 V DC

X33 – PTC card

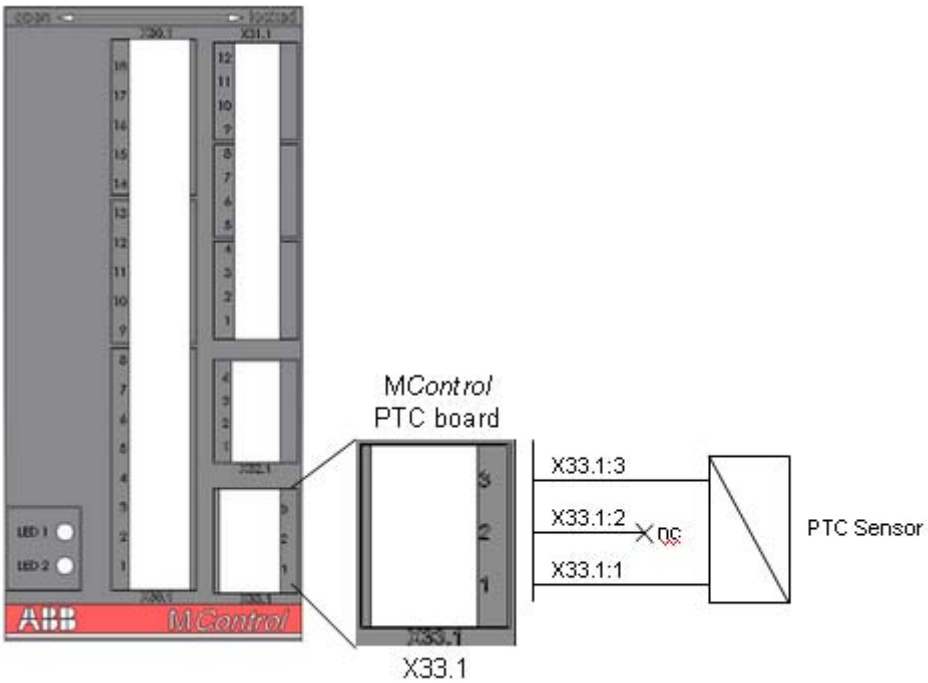


Figure 35 Connection diagram X33 – PTC

Technical Data

Broken wire resistance	> 10 kΩ
PTC range	0 – 10 kΩ
Refresh time	< 200 ms
Line length (shielded)	2.5 mm^2: 2 x 350 m 1.5 mm^2: 2 x 200 m 0.5 mm^2: 2 x 70 m
Isolation	Yes
Accuracy	< 1 %
Open loop voltage	5 V DC

X32 – Analog I/0 cards

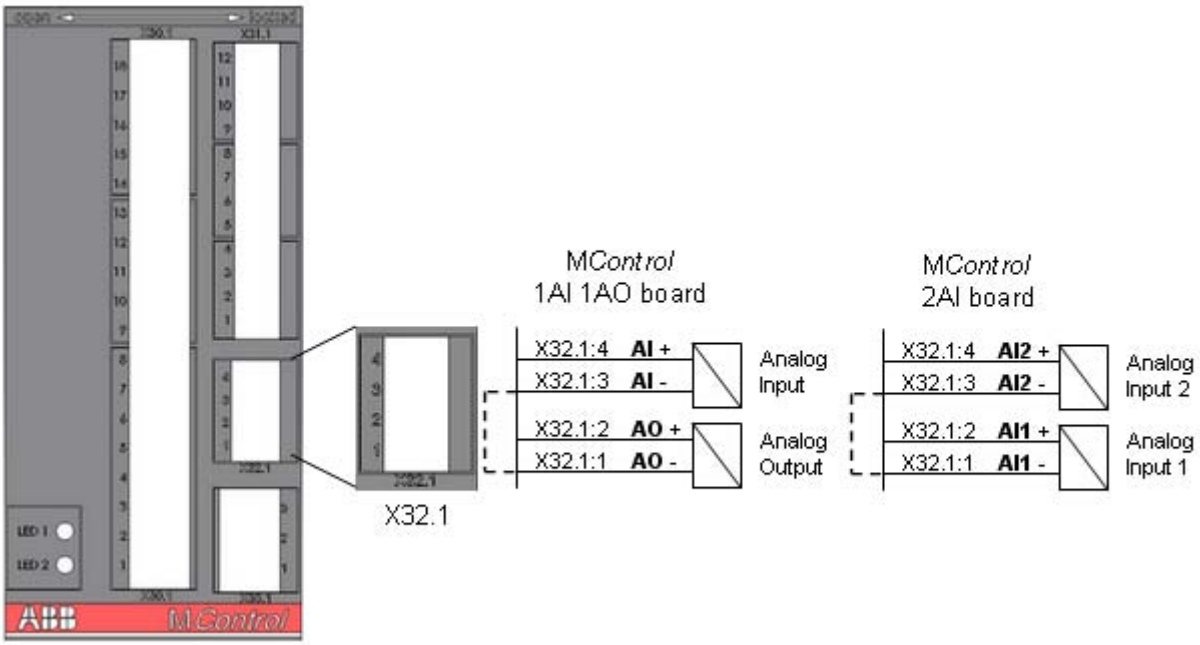


Figure 36 Connection diagram X32 – Analog In-/Outputs

Technical Data

	configured as current input	configured as voltage input
Analogue Input		
Configurable input range	0 – 20 mA	0 – 10 V
Max. input current (measurable)	30.6 mA	
Max. input voltage (measurable)		15.3 V
Accuracy	< 1 %	
Input resistance	250 Ω	1 MΩ
Resolution	8 bit	
Isolation	Yes	
Line length (shielded)	2 x 200 m (0.5 – 1.5 mm^2)	
Analogue Output		
Configurable output range	0/4 mA – 20 mA	0 – 10 V
Max. output current (measurable)	20.4 mA	
Max. output voltage (measurable)		10.2 V
Accuracy	< 1 %	
Max. output load	600 Ω	100 kΩ
Resolution	8 bit	
Short-circuit proof	10 s	
Isolation	Yes	
Line length (shielded)	2 x 200 m (0.5 – 1.5 mm^2)	
Broken wire voltage	16 V DC	

X34 – Profibus Direct Interface

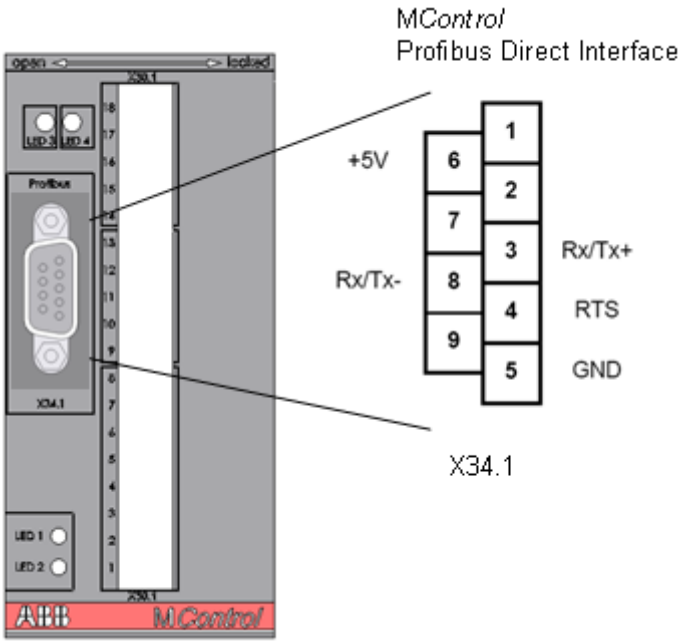


Figure 37 Connection diagram X34 – Profibus Direct Interface

2.4 Connection of M*Connect*

Connection of M*Connect* boards is similar to M*Control* connection.

2.5 Connection of Conventional feeders

Pin assignments on the control condapter connectors for conventional feeder modules, valid for module sizes 6E/4, 6E/2 and ≥ 6E:

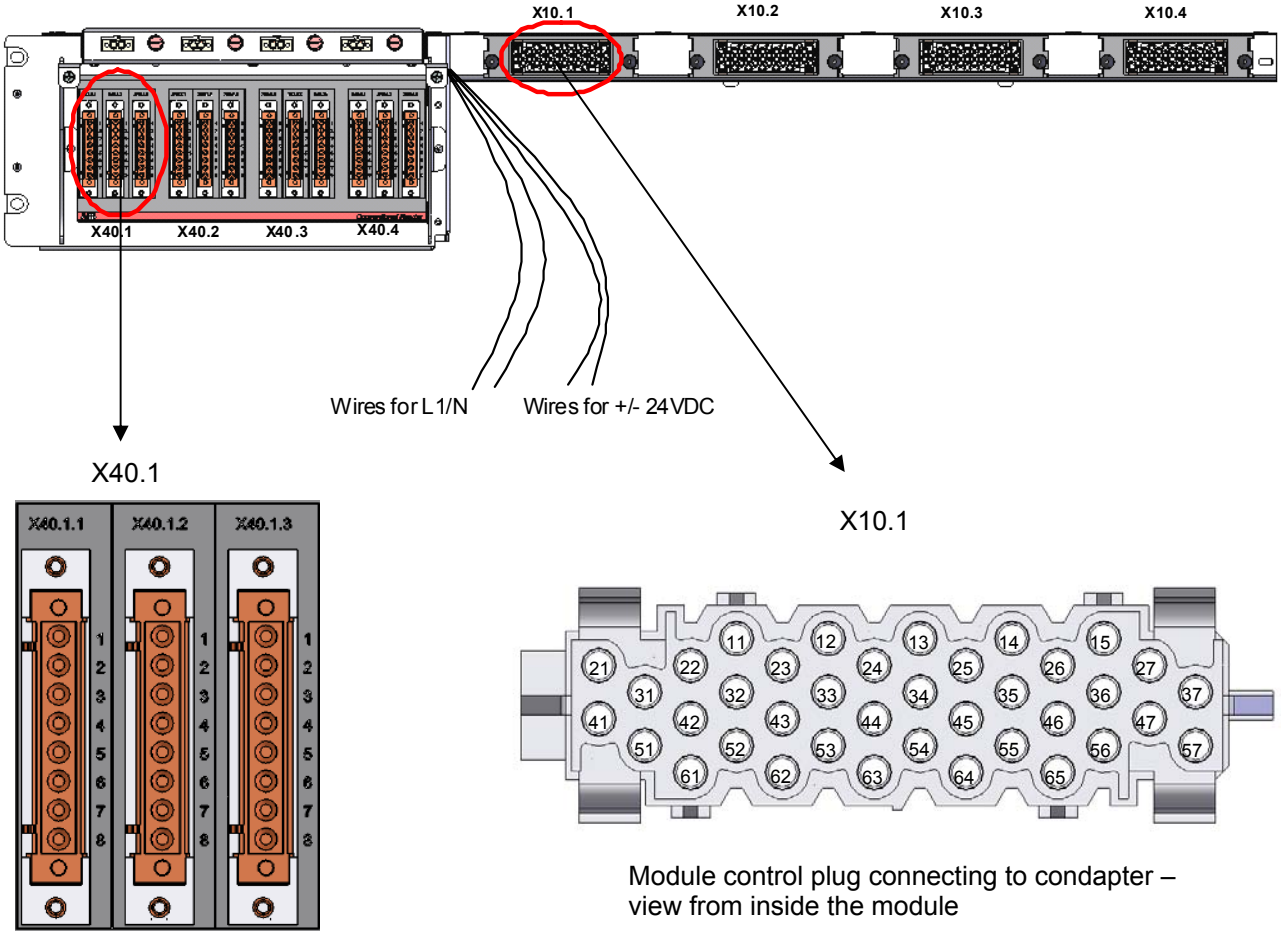


Figure 38 Connection of conventional feeders – pin assignment X40 – X10

Example: Terminal pin assignment for X40.1 to X10.1:

3x8 pole control plug at control condapter			38 pole control plug at withdrawable module		
X40.1.1.	1		X10.1.	12	The terminal pin assignments of X40.2 – X10.2 X40.3 – X10.3 X40.4 – X10.4 are according to this example.
	2			-	
	3			-	
	4			13	
	5			22	
	6			23	
	7			24	
	8			25	
X40.1.2.	1		X10.1.	21	
	2			31	
	3			32	
	4			33	
	5			34	
	6			35	
	7			36	
	8			37	
X40.1.3.	1		X10.1.	11	
	2			41	
	3			51	
	4			46	
	5			27	
	6			47	
	7			57	
	8			-	
External wires					
L1			X10.1.	14	
N				15	
+ 24V			X10.1.	44	
- 24V				45	

2.6 M*Link* Setup

2.6.1 General

The communication interface module M*Link* collects information from the connected M*Control* units.

Maximum units per M*Link*:
- 7 cubicles or
- 60 modules

In case more cubicles/ modules are required, several M*Link* units are linked via a Network Switch.

2.6.2 Interfaces and Annunciation

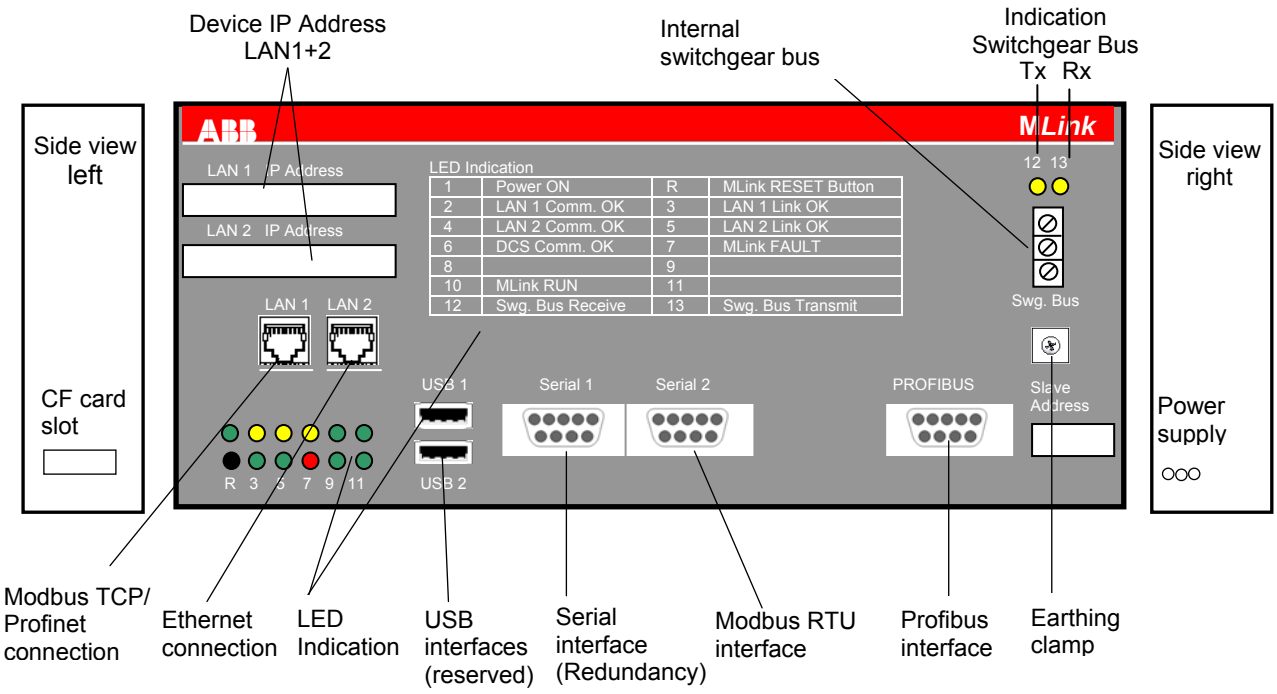


Figure 39 M*Link* interfaces and annunciation

2.6.3 Compact Flash (CF) Card

The compact flash card contains:
- Operating System
- IP address
- M*Link* parameters
- Fieldbus parameters

The card is inserted to the slot at the left side of the M*Link* unit. As soon as the flash card is inserted and M*Link* is connected to the voltage supply, M*Link* starts polling the M*Control* units connected to the switchgear network.

2.6.4 Installation and Connection

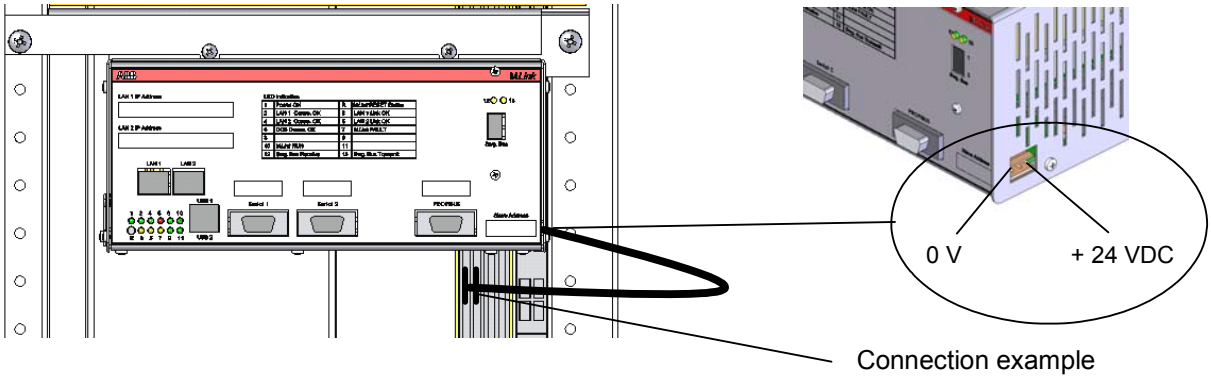


Figure 40 M*Link* installation

2.6.5 Bus wiring in multiple cubicles

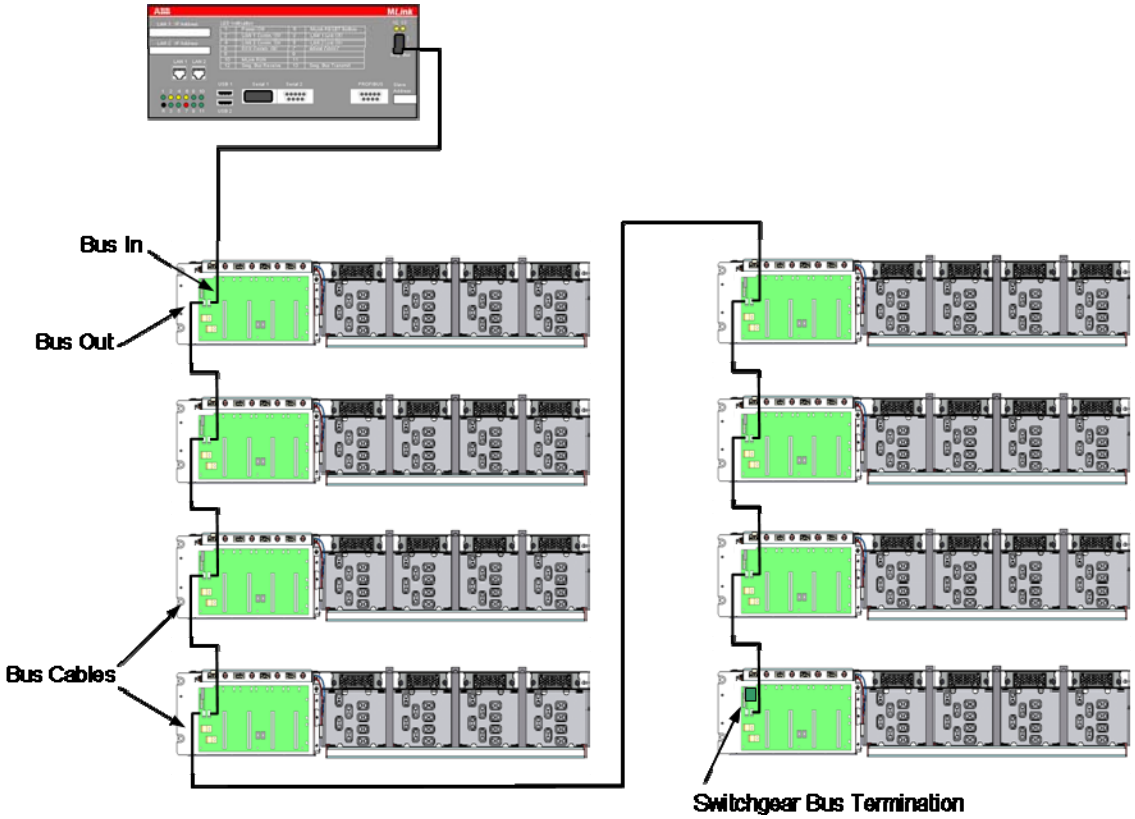


Figure 41 Bus wiring in multiple cubicles

2.6.6 Bus wiring in multiple cubicles, dual redundant configuration

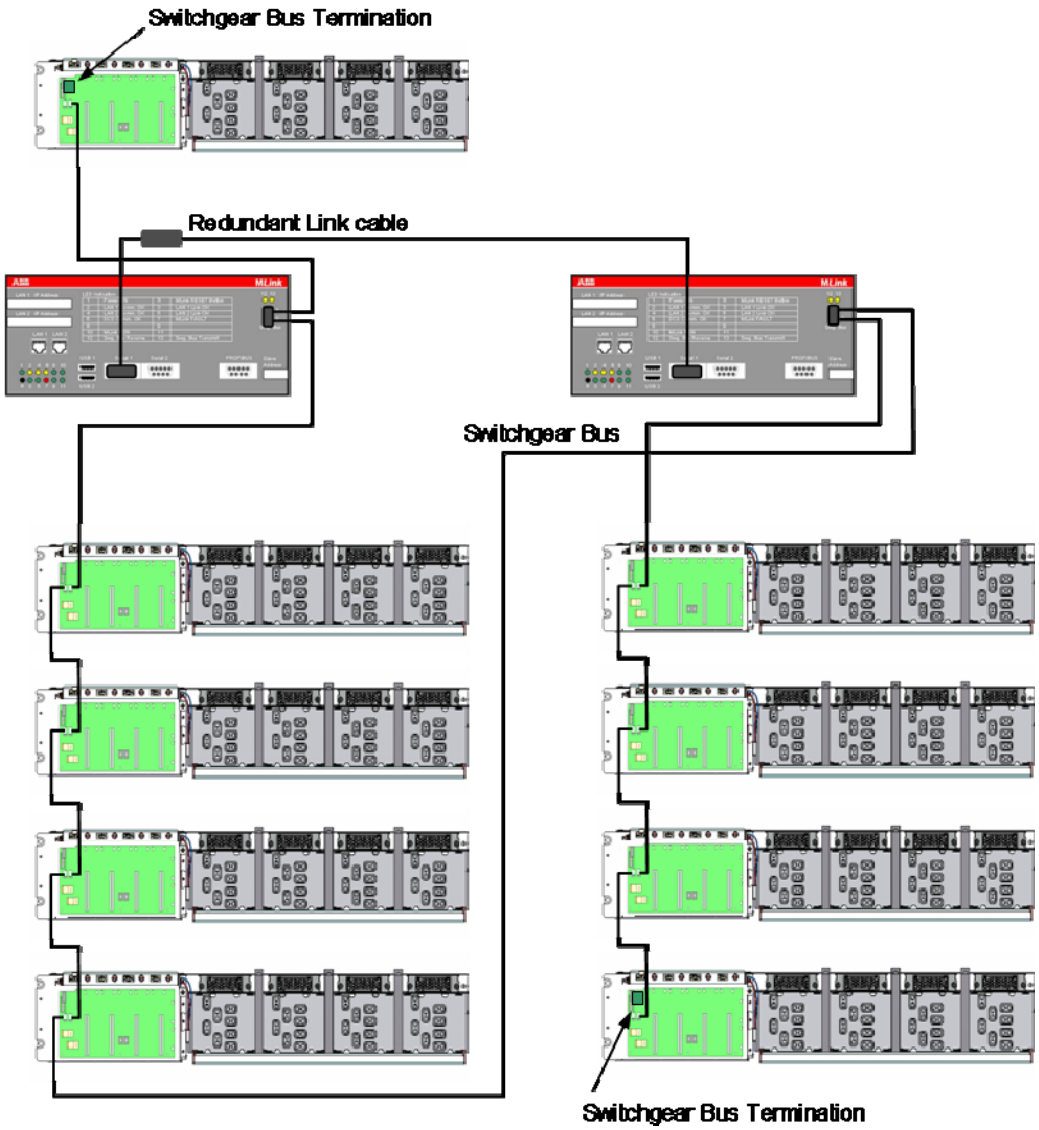


Figure 42 Bus wiring in multiple cubicles – Redundant M*Links* approved topology example 1

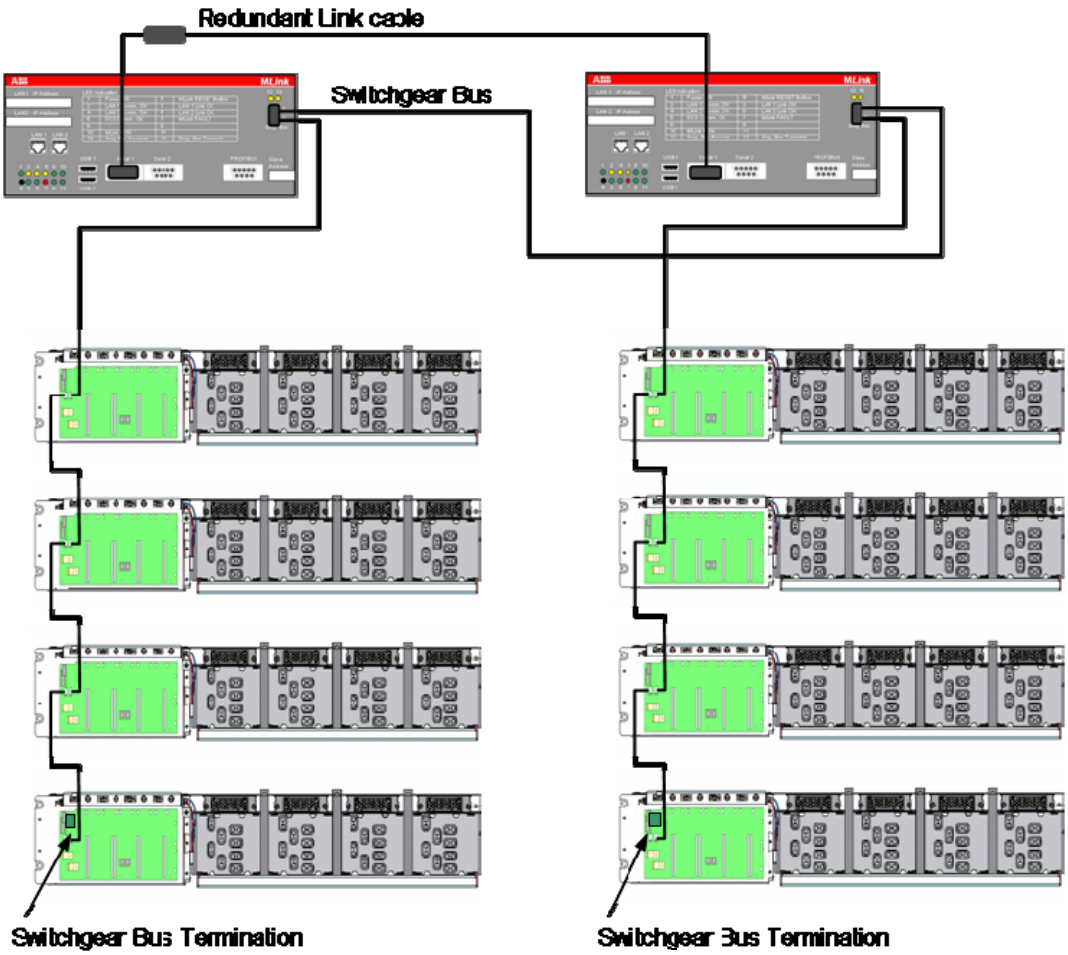


Figure 43 Bus wiring in multiple cubicles – Redundant M*Links* approved topology example 2

2.7 M*View* Setup

A standard touchscreen running web browser software is used as M*View* mounted at a central place in the switchboard.
General information on M*View* functionality is given in section MNS *i*S Design & Components, page 19.

The touchscreen is installed in the control cable room door and connected to M*Link* as shown in Figure 44 hereunder.
Note: Figure 44 refers to the ABB's standard device, however also other industrial touch-screens can be used.

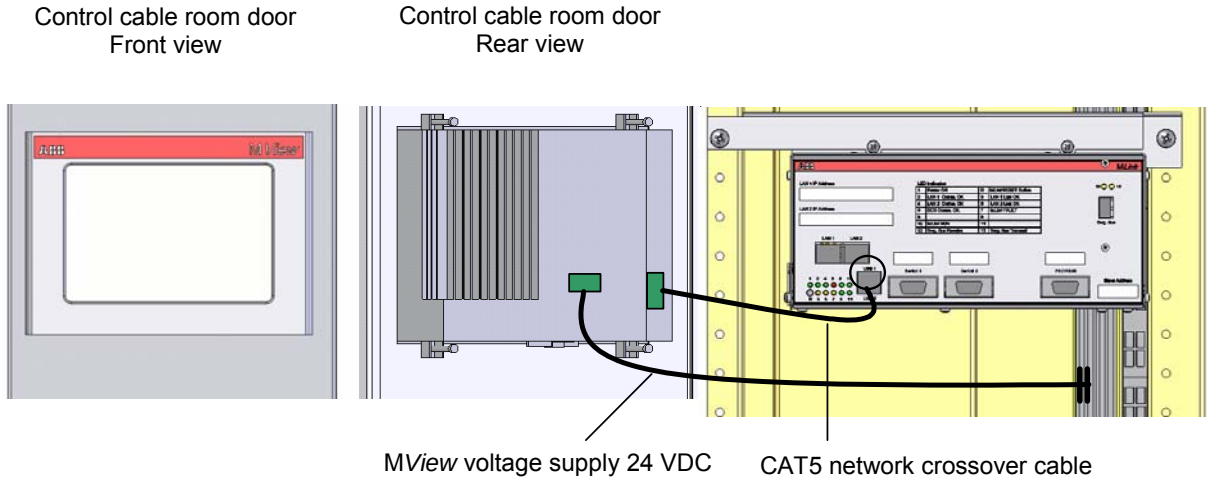


Figure 44 M*View* installation and connection

2.8 M*Start* / M*Feed* installation

M*Start* / M*Feed* modules installation depends upon the type and function of that particular application defined within the ABB Engineering software. The M*Control* associated with the power module confirms that the correct power module is utilised, if there is a conflict a 'location supervision' alarm is activated. Therefore any mismatch of applications or power ratings is prevented.

For more information on module operation, please see section MNS *i*S Operation, page 52.

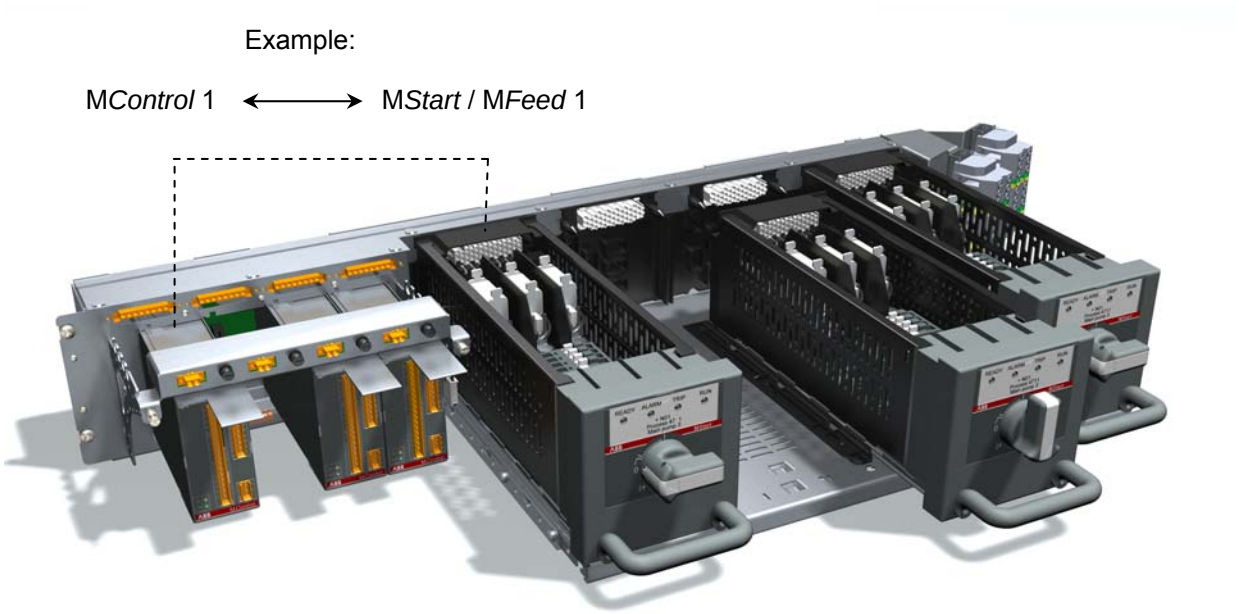


Figure 45 M*Control* and M*Start* / M*Feed* connected to control and power condapters

2.9 Project specific parameterization via M*Navigate*

The parameterization tool M*Navigate* is used for setting/ editing project specific parameters.

Note:
Precondition for the use of M*Navigate* for above actions is the availability of an MNS *i*S **project application** imported from the ABB Engineering tool.
This application contains all plant specific fixed information for example

- the device list (M*Start*, M*Feed*, M*Control*, M*Link*)
- device locations
- used hardware options (e.g. M*Control* extension cards).

Hence parameterization with M*Navigate* only refers to the alterable attributes like

- **parameters**
  (motor characteristics, protection settings)
- **configuration parameters**
  (M*Control* I/O settings)

Help files for M*Navigate* users are available via

- the M*Navigate* entry in the Windows Start menu or
- the “Help” button in the upper M*Navigate* navigation bar
- as a separate chm file

These files contain information on

- M*Navigate* Software itself
- Starter, Control, Protection and Maintenance Functions

View options for the content are

- order by fixed content sections
- order by index words (incl. details like single parameters)
- search function

For more information on M*Navigate*, please refer to

- the M*Navigate* online help, see section hereunder
- the M*Navigate* help file as separate chm file.

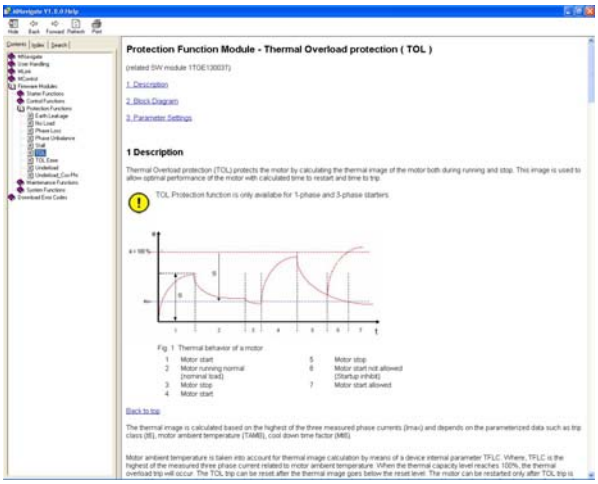


Figure 46 Help function

Parameterization steps:

(1) After program startup and project data import the **start page** is shown.

Use the following buttons for further actions:


Change Switchgear Tree View to Network Tree View (alternating button)


Change Network Tree View to Switchgear Tree View


Collapse Tree


Expand Tree


Close Tree View (alternating button)


Open Tree View


Help


Show Event Log (Download History)


Hide Event Log


Close current project and open startup window to select another project

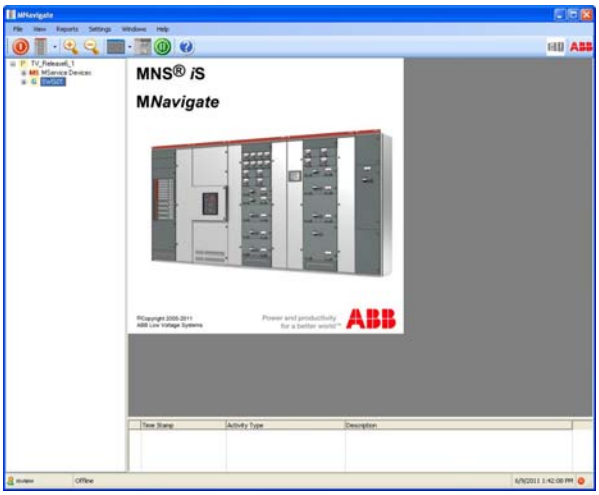


Figure 47 M*Navigate* Start View

(2) Views and device selection


selects the **Switchgear tree view** in the left navigation showing all MNS *i*S components belonging to the particular project.


is used for changeover to **Network tree view** showing M*Link* allocation.

Symbols mean the following:

- P Project name
- G Switchgear name
- C Cubicle name
- M M*Link* name
- m M*Control* (motor starter)
- f M*Control* (feeder)


is used for changeover to **Bitmap view** which delivers a switchgear front view in the main window. Selection of M*Control* units for further actions can also be done from here.

Figure 48
Switchgear tree view

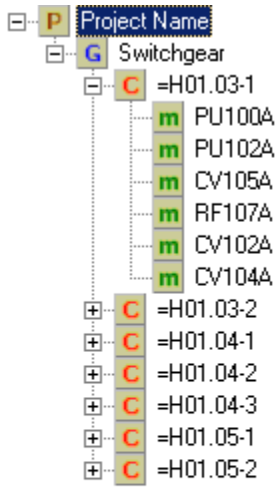
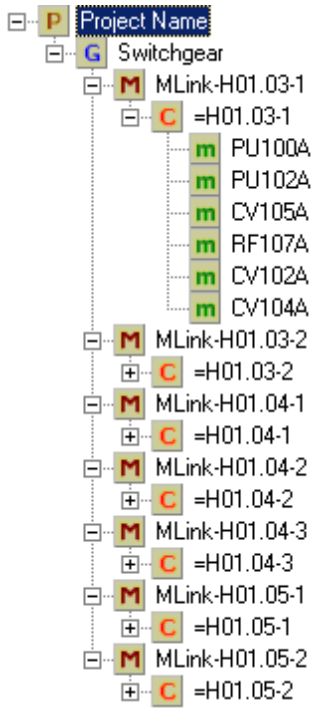


Figure 49
Network tree view



To select an **M*Control*** from the Tree view, simply right click with the mouse, this will, in one action select the required M*Control* and show the functions that are possible for that particular module.

Alternatively the M*Control* can be selected from the **Bitmap view** (Switchgear front view)

For each M*Control* you have the options to:

- Parameterize
- Download
- Assign to M*Control*s

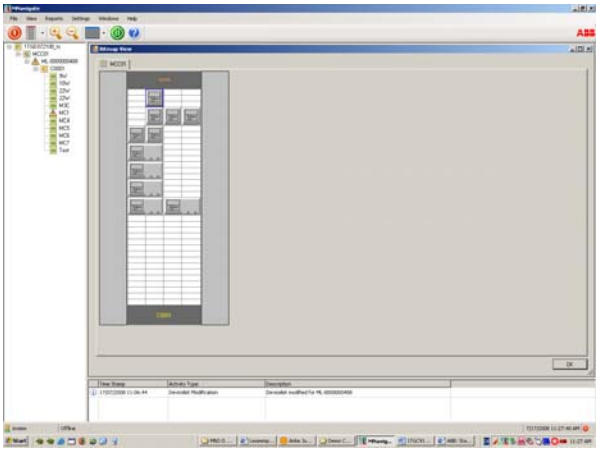


Figure 50 Bitmap view (switchgear front view)

(3) Parameterization

The **M*Control* Parameterization screen** is open in the window area once the Parameterize option has been selected for the particular module.

Note:
The parameters shown here are those held within the M*Link* (CF Card). The parameters are not changed in the M*Control* until they have been downloaded.

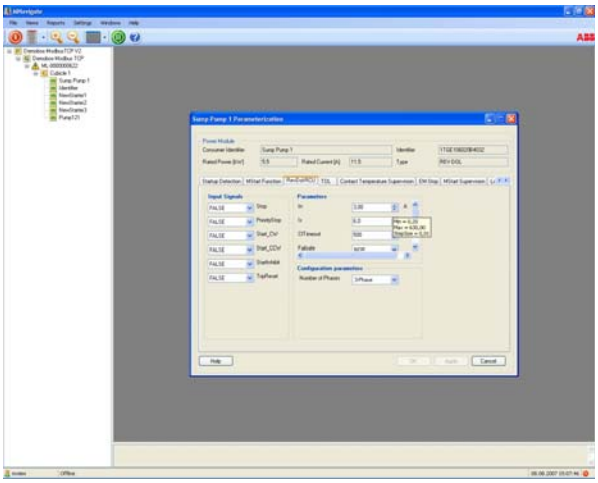


Figure 51 M*Control* parameterization screen

A parameterization window has different areas.

In the top area the M*Start* data is shown (Consumer Id, M*Start* Id, Power and Current Rating and Starter type). This data is not editable, and is imported from the ABB Engineering tool.

The area below is used for the firmware module and its settings. Each firmware module has its own window. Only those applications are presented, which are available for the selected M*Control*/M*Start*. Depending on the firmware function the module has

- motor related parameters and
- configuration parameters

The change of configuration parameters alters the functions of the M*Control* I/Os.

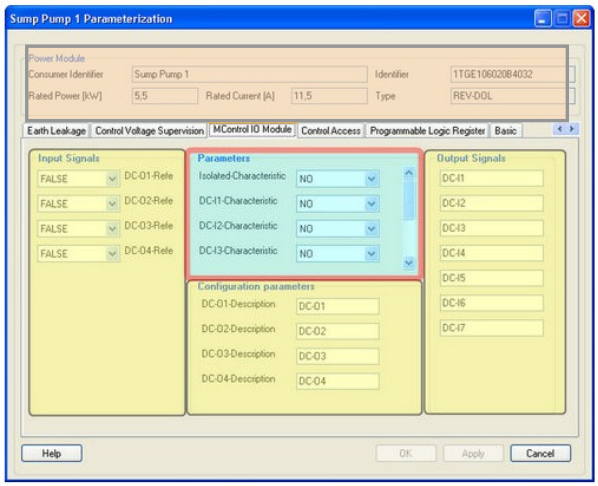


Figure 52 Parameterization window sections

Within the parameterization window it is possible to toggle forwards and backwards with the arrow keys on the right hand side of the window. This will then display the list of parameters available for the selected module. It is also possible to select the required protection function by the name tab.

To edit / enable / disable functions is simply a matter of editing the values available in the fields, moving the cursor over the field shows the available values for that particular field.

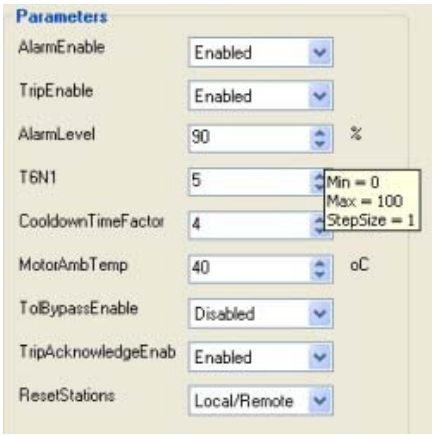


Figure 53 Parameter list (example)

Once a field is edited and **Apply** is selected, the information is saved within the M*Navigate* package. The icon for the particular M*Control* in the Tree View changes from the normal  M*Control* icon to the  warning icon.
Now the parameters in the M*Navigate* differ from those in the actual M*Control*.

User can now proceed to edit more parameters. Each time a field is edited and shall be saved, select 'Apply'.

'Cancel' discards the data input.
'OK' closes the parameterization window returning to the start page.

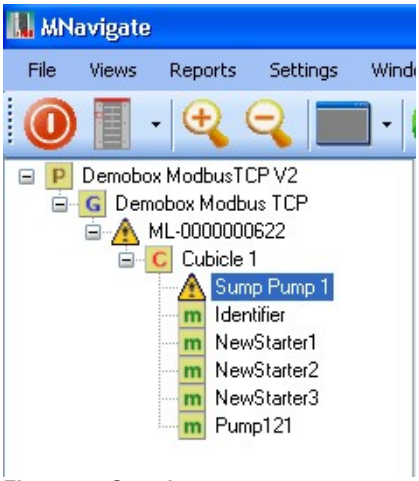


Figure 54 Saved parameters

(4) Parameter download

To **download the edited parameters** to the M*Control*, select 'Download', then 'Parameters' from the options given from 'right clicking' on the required M*Control*.

For information on the status of the parameter download select the  event log icon from the toolbar, this opens an additional pane at the bottom of the screen.

As long as the download is in process the indicator in the bottom left hand corner of the screen flashes Green, in addition the status is given in the event log window. Once the download has been completed the indicator the bottom left hand corner returns to the steady state Red condition, conformation is also given in the event log window, and the M*Control* icon returns to the  state.

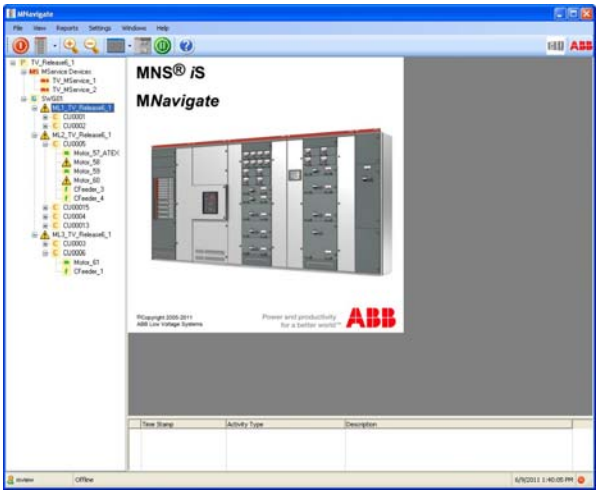


Figure 55 Download of parameters

(5) The option **Assign to M*Control*** allows the user to copy the settings of one M*Control* to other M*Controls*.

Select one M*Contro*l to be the data source.

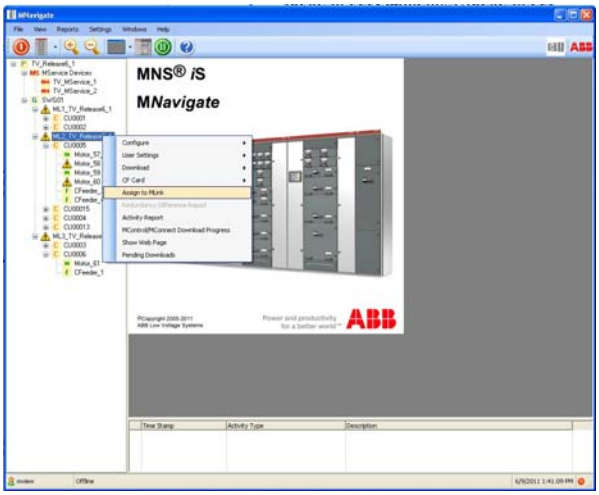


Figure 56 Assign parameters

Within the **Copy configuration** window, all target M*Controls* are selected from the left list to the right list. Re-moving them to the left discards the assignment.

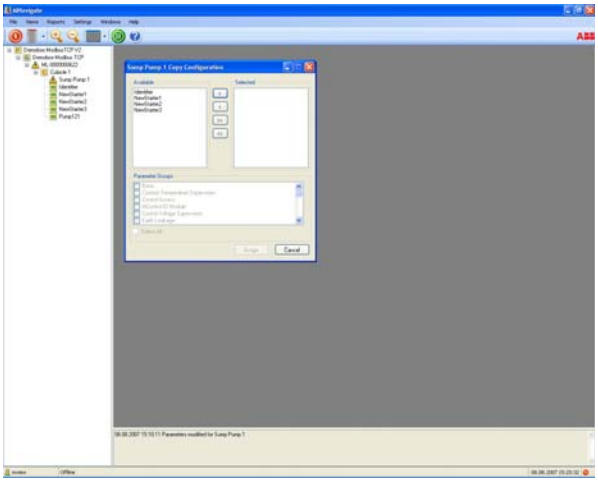


Figure 57 Copy parameters

Afterwards all parameter groups to be copied are selected in the respective window.

After selection, user must click on 'Assign' to copy the data to all selected M*Controls*.

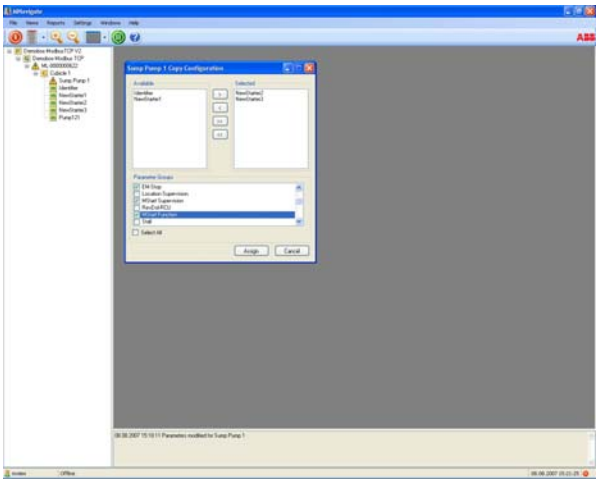


Figure 58 Choose parameter groups to be copied

3 MNS *i*S Operation

3.1 Withdrawable module operation and interlocking

MNS *i*S withdrawable power modules are operated with the module operating handle. This handle also activates the electrical and mechanical interlocking of the module.

Handle positions are shown in Figure 61.

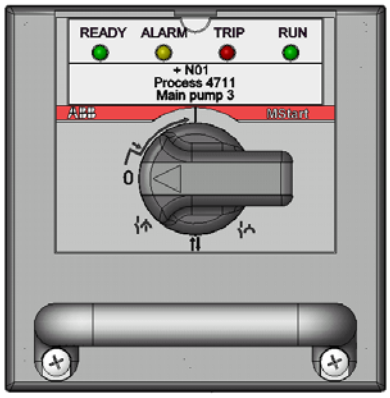


Figure 59 Power module front view

Status information such as ON, OFF, READY, ALARM, TRIP can be indicated with the 4 LED's above the module operating handle.

The allocation of status information to these LEDs is defined with the project configuration data and can be modified with M*Navigate*. The label attached to the module indicates the motor/starter identification as well as the LED function, see Figure 60.

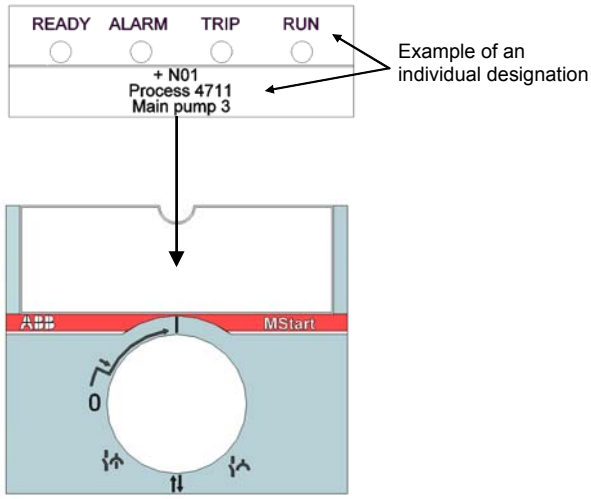


Figure 60 LED designation example

Withdrawable modules operation/interlocking modes

Position			Mechanical status		Electrical status		
6E/4, 6E/2	6E…24E	Designation	Module interlocked	Padlock possible	Withdrawable contacts	Main switch	Control circuit
		ON position (I)	✓	---			
		OFF position (O)	✓	✓			
		Test position	✓	✓			
		Disconnected position (Isolated position)	✓ 30 mm withdrawn	✓			
		Moving Position (Withdrawn position)	--- removal possible	---	 or		

Figure 61 Operating handle positions

3.2 Fixed module operation and interlocking

Status information LEDs (incl. label) are installed in the front door of the central compartment of fixed M*Start* modules.

Characteristics are the same as for withdrawable M*Start* modules, see page 52.

Fixed modules operation/interlocking modes

Position		Mechanical status		Electrical status		
85E 6E…24E	Designation	Module interlocked	Padlock possible	Withdrawable contacts	Main switch	Control circuit
	ON position (I)	✓	✓ (optional)			
	OFF position (O)	✓	✓			
	Test position	✓	✓			

3.3 Motor operation

3.3.1 Operation modes

Location	Operation via	Operation mode	See section
Motor	Pushbutton at local control panel	Local	3.3.3
Switchgear room	M*View*	Bus-Local	3.3.5
DCS	DCS Command	Remote	3.3.4

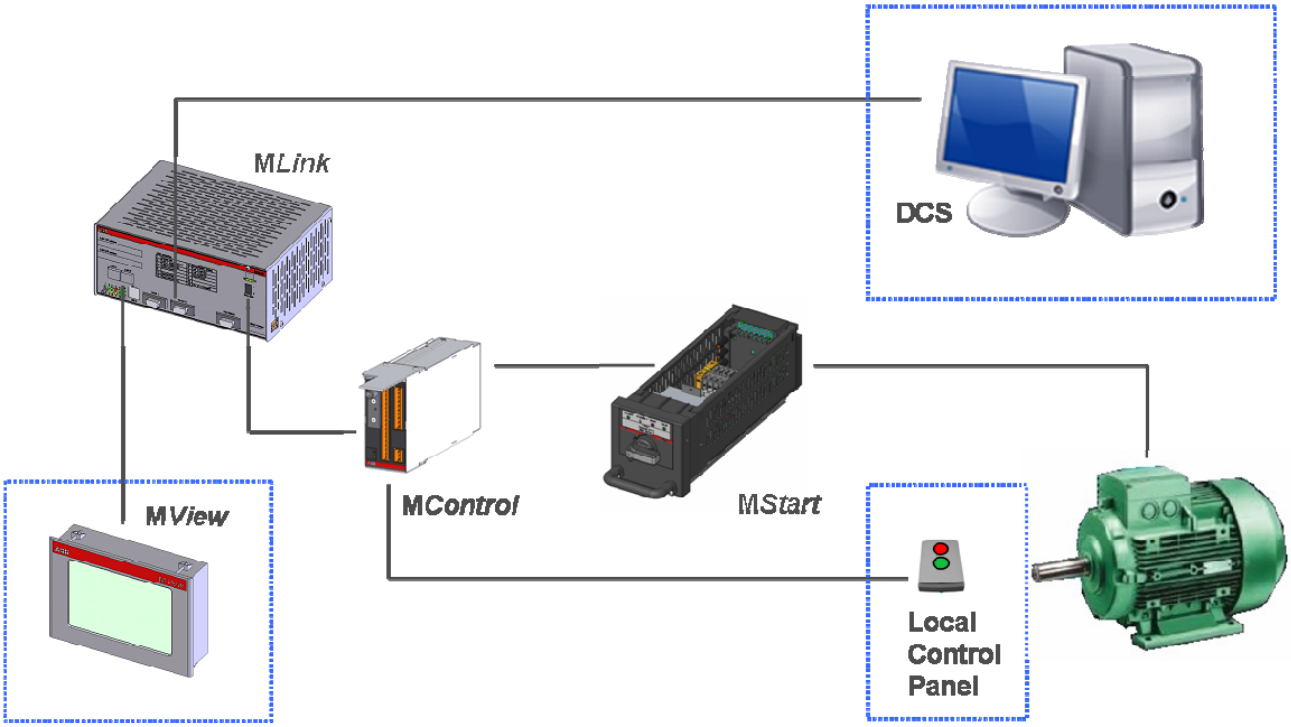


Figure 62 Operation modes

3.3.2 Control Access

Before operators at any location are able to send a command, a control access request must be sent to the M*Control*.

3.3.3 Local motor operation

Motors can be operated from a local control panel which is connected to M*Control* digital inputs (DI).

There are 2 alternatives to enable local operation:

Hardware-Local:
Selector switch (local/remote) at the local control panel hard-wired to M*Control* digital inputs (DI)

Software-Local:
DCS command sent to M*Link,* enabling local control panel to operate the motor

3.3.4 Remote motor operation via DCS

Details of communication with DCS using Profibus or MODBUS can be obtained from the respective MNS *i*S Interface Manuals (see page 72).

3.3.5 Motor Operation via Human Machine Interface (Web Interface)

Motors are operated via the MNS *i*S Web Interface by connecting

- an M*View* unit or
- a standard PC

to one M*Link* in the switchgear.
These devices run a standard web browser enabling them to communicate with the M*Link*.

1) The first step is to enter the **IP address** (e.g. http://192.168.200.100) of any M*Link* in the network into the browser address bar.

A list of all connected M*Links* shows up. Select one M*Link* by touching the related button, e.g. Pump Station 1.

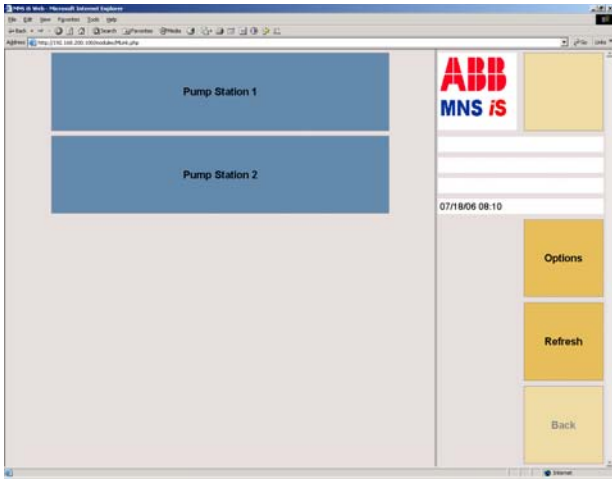


Figure 63 Addressing

2) A **logon screen** appears after choosing one M*Link.*

User and password is entered via the virtual keyboard in the M*View* window (or optionally by a real keyboard if existing). After pressing the Logon button the entered data is checked (according to the user definition).

Note:
Default user: mview

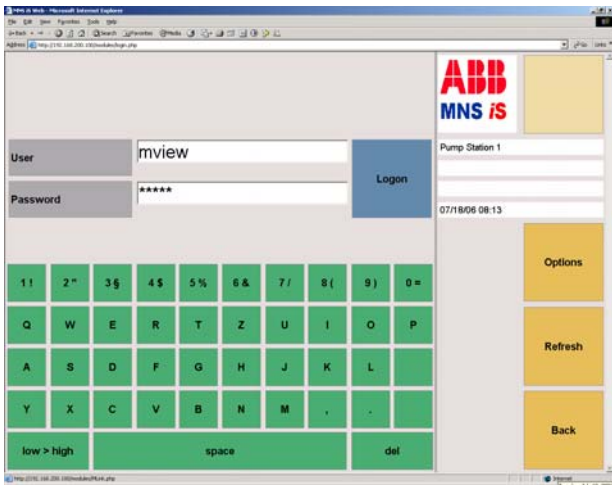


Figure 64 Logon

3) If the password is correct the user is logged in and the user name appears in the yellow field besides the ABB sign. Clicking on “Log off” will cancel this step and user gets back to the logon screen (see step 2).
The **switchgear view** appearing after logon shows a list of all cubicles (max. 7) containing configured M*Control* devices.

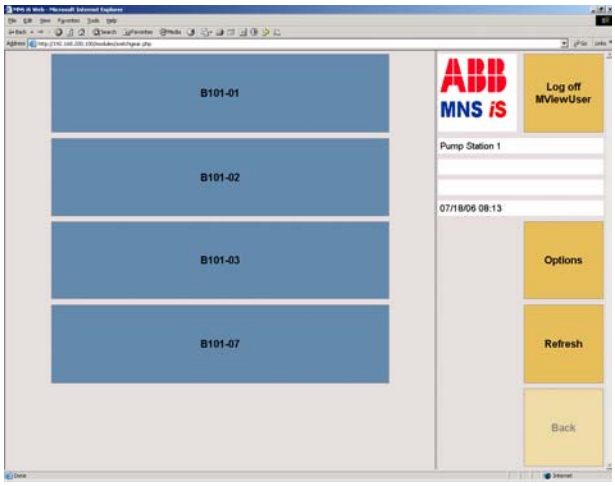


Figure 65 Switchgear view

4) After choosing e.g. B101-01, the **cubicle view** of B101-01 appears, showing the position of the devices in the cubicle.
The green navigation buttons are used to navigate between the single modules. Blue buttons are used to select the operate or setup view for this particular starter module.

Use the yellow “Options” button to change between indication of different M*Link* and M*Control* (motor) identifiers.

Figure 66 Specific cubicle view

M*Control* colors indicate the current status of the particular device.

The operate view can be called for all M*Control* devices that are indicated online.

- Configured but currently absent
- In place but offline
- Online and switched on
- Online and switched off
- Online and tripped
- Online, switched on and alarm
- Online, switched off and alarm
- Online, tripped and alarm
- X — Configured according to device list but application file missing (M*Control* application download required) and device currently absent
- X — Online, application file missing (M*Control* application download required)

5) The **operate view** is the main view for monitoring and operating a starter module via its M*Control.*
Use the green button “Show diagnostics” to change between

- measurement values
- diagnostics (service information)
- device status

Motors are started/ stopped using the blue buttons at the bottom.

Press the button twice for

1. **Selection** (button changes colour from light to dark blue, indicating “ready for activation”)
2. **Activation** (activates the required function)

Appearing alarms/trips are shown with red and blue indicators next to the Alarms/trips window. Pushing the red or blue button opens the alarm/trip view.

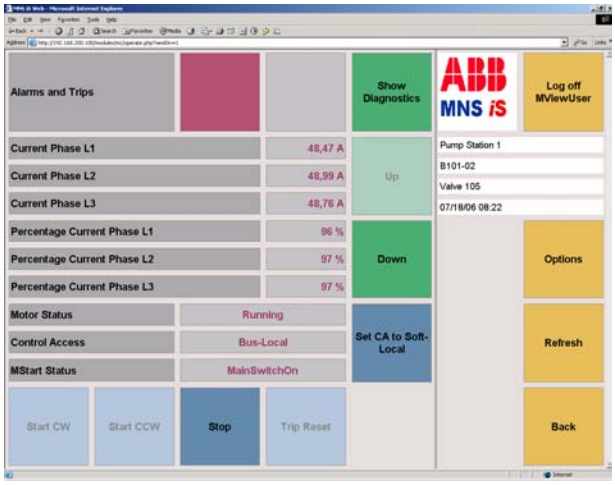


Figure 67 Operate view

6) A detailed **alarm/trip view** appears after pressing the blue or red indicators in the Operate view (see step 5). Time stamp relates to the last change of M*Control* alarm/event information.

If the list extends the screen size, use “Up” and “Down” buttons to scroll.

Use the yellow “Options” button to change between indication of either

- the complete alarms/events list (with active alarms marked) or
- only active alarms/events

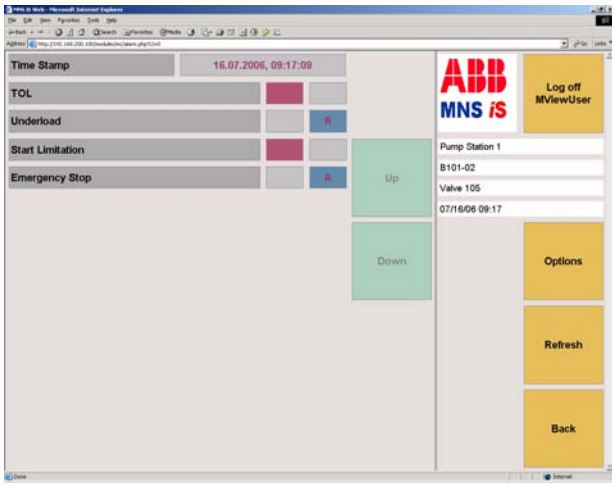


Figure 68 Alarm/Trip View

Different alarm/trip and reset situations are distinguished with a variety of indicators.

The system acts in accordance with the selected **reset parameters** for each drive and each single protection function.

No alarm no trip

Trip

Alarm

Alarm and Trip

Trip resettable (trip situation removed)

Trip acknowledged (trip will be reset as soon as trip situation is removed)

7) Via the **Device Setup menu** downloads of configuration data, parameters and new firmware are initiated.

Precondition:
Prior to the download any necessary modification of configuration data or parameters has to be executed via M*Navigate* and made available in M*Link*.

Depending on the user's profile some of the options may not be available (light blue buttons). After execution of selected operations, result messages come up in the 2nd column (grey fields).

Note:
For configuration data download the corresponding M*Control* unit has to be set offline.

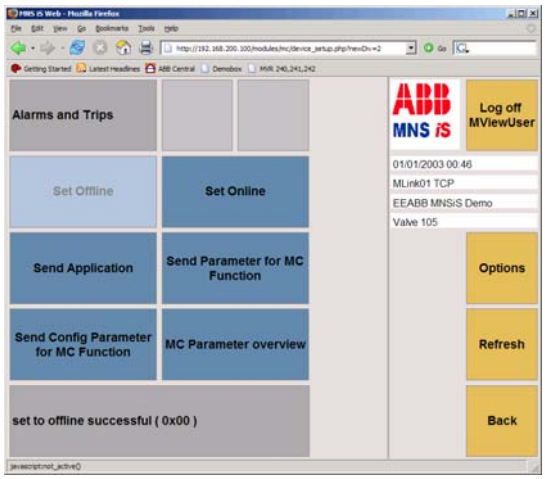


Figure 69 Device setup menu

8) By selecting the option 'MC Parameter overview' it is possible to view the protection functions (applications) that have been selected for that particular module.

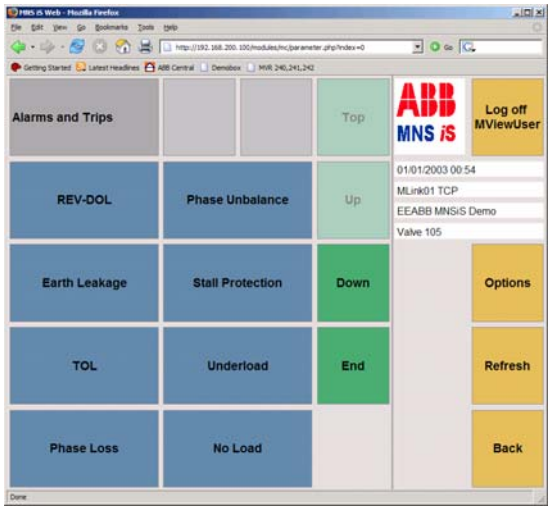


Figure 70 MC Parameter overview

9) To then view the parameter details select the required function to review.

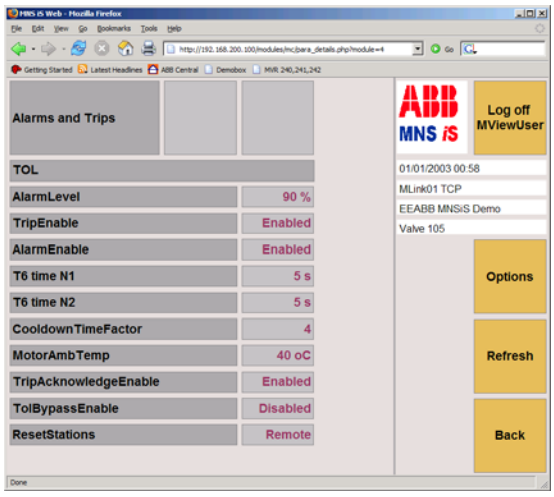


Figure 71 Parameter details

3.4 Alarms and Trips

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
M*Start* Communication Error		X		No communication between M*Control* and Power Module (M*Start*/ M*Feed*) or no Power Module inserted **<u>Condition</u>** **Power Module Main switch has been in OFF position before communication loss**.	No communication between MControl and Power Module (MStart/ M*Feed*) or no Power Module inserted **<u>Condition</u>** **Power Module Main switch has been in ON or Test position before communication loss.**
M*Start* ID or Range Error		X		n.a.	**M*Start* ID Error :** Difference between configured setting in M*Navigate* (Maintenance Functions -> M*Start* Supervision) and actual Power Module (e.g. M*Start*) inserted. **Range Error :** Setting for nominal current (In) is not matching the current range of the actual inserted Power Module (e.g. M*Start*)
In the next section the Contactor Feedback signal is a hardwired signal used by the power module to monitor the status of the Contactor i.e. Open or Closed, against the desired status.					

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
Location Supervision		X		n.a.	M*Control* inserted in wrong location (other than specified) Suggested action: • check expected "M*Control* Location" settings in M*Navigate* -> Reports -> Topology -> Network View and compare with actual address setting in cubicle / rotary switch of Control Condapter • If M*Control* has been moved from another location then Download M*Control* Application/Parameter/ Configuration
Motor Still Running	X	(X)	X	n.a.	Contactor feedback after OFF command ok, but current still detected Suggested action: • Check / Replace Power Module
Unexpected Feeder Current	X	(X)		n.a.	Contactor feedback after OPEN command ok, but current detected Suggested action: • Check / Replace Feeder Module
Welded		X		n.a.	Contactor feedback after OFF command missing and current detected Suggested action: • Switch Main switch to OFF • Check / Replace Power Module

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
Motor Not Running	X	(X)	X	n.a.	Contactor feedback after ON command ok, but no current detected Suggested action: • Check that motor cable is connected to motor and Power Condapter terminals • Check Motor • Check that selected Starter Type in M*Control* application fits to real Motor / Feeder Application, e.g. NR-DOL starter type configured for an energy distribution application.
Feedback Supervision (K1,K2,K3)	X	X		Contactor Feedback from does not correspond with motor status **Condition** **Current as expected**	Contactor Feedback does not correspond with motor status **Condition** **Even current not as expected** Suggested action: • Check "CF Timeout" parameter setting • Check / Replace Power Module
Test Mode Failure		X		n.a.	M*Start*/ M*Feed* is in test position but current detected Suggested action: • Check / Replace Power Module
Main Switch Supervision		X		Main switch off (motor not running) Note: Alarm indication only if Alarm parameter is set to *Enabled* !	Main switch off while motor is running Note: Trip only if Trip parameter is set to *Enabled* !

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
No Load	X			Highest measured phase current is below the parameterized Alarm level.	Highest measured phase current is below the parameterized Trip level.
Underload	X			Highest measured phase current is below the parameterized Alarm level $\mathbf{I_{Lmax}}$.	Highest measured phase current is below the parameterized Trip level $\mathbf{I_{Lmax}}$.
Underload CosPhi	X			**Cos Phi** value is below the parameterized Alarm level.	**Cos Phi** value is below the parameterized Trip level.
TOL	X			Alarm level reached **% of thermal image**	Trip level reached **100% of thermal image (fix)** Note: DCS TOL-Bypass command available to set Trip level to 200% of Thermal Image. **This is not applicable for TOL Exe protection function!**
Stall	X			Motor current higher than parameterized Alarm level.	Motor current higher than parameterized Trip level.
Phase Failure	X			Ratio of highest phase current $\mathbf{I_{Lmax}}$ compared to lowest phase current $\mathbf{I_{Lmin}}$ is lower than parameterized Alarm level.	Ratio of highest phase current $\mathbf{I_{Lmax}}$ compared to lowest phase current $\mathbf{I_{Lmin}}$ is lower than parameterized Trip level.
Phase Unbalance	X			Ratio of highest phase current $\mathbf{I_{Lmax}}$ compared to lowest phase current $\mathbf{I_{Lmin}}$ is higher than parameter-ized Alarm level.	Ratio of highest phase current $\mathbf{I_{Lmax}}$ compared to lowest phase current $\mathbf{I_{Lmin}}$ is higher than parameterized Trip level.
Undervoltage	X			Phase voltage is lower than parameterized Alarm level ratio $\mathbf{U_{Lmin} / U_n}$	Phase voltage is lower than parameterized Trip level ratio $\mathbf{U_{Lmin} / U_n}$
Control Voltage Supervision			X	Control voltage dip **< 95% U_n (fix)**	Control voltage dip **< 65% U_n (fix)**
PTC Supervision	X			Alarm level reached **R = 1650 Ω (fix)**	Trip level reached **R = 3600 Ω (fix)**
PTC Supervision Short Circuit	X			n.a.	PTC value lower than parameterized Short Circuit Trip level $\mathbf{R_{short\ circuit}}$
PTC Supervision Open Circuit	X			n.a.	PTC value higher than fixed Trip level for open circuit $\mathbf{R_{open\ circuit} \geq 10k\Omega}$ **(fix)**

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
PT100 Low Level (Sensor 1,2,3)	X			PT100 value lower than parameterized Alarm level **PT100 Low Alarm Level**	PT100 value lower than parameterized Trip level **PT100 Low Trip Level**
PT100 High Level (Sensor 1,2,3)	X			PT100 value higher than parameterized Alarm level **PT100 High Alarm Level**	PT100 value higher than parameterized Trip level **PT100 High Trip Level**
PT100 Card Failure			X	PT100 Measurement not working: • Card not connected • Card hardware failure No PT100 low/high alarms & trips initiated **Condition** **PT100 Card Failure Trip disabled** Suggested action: • Check Sensor wiring • Replace M*Control*	PT100 Measurement not working: • Card not connected • Card hardware failure No PT100 low/high alarms & trips initiated **Condition** **PT100 Card Failure Trip enabled** Suggested action: • Check Sensor wiring • Replace M*Control*
PT100 Short Circuit (Sensor 1,2,3)	X			n.a.	Short circuit on sensor line detected **PT100 short circuit** Suggested action: • Check Sensor wiring for short circuit
PT100 Open Circuit (Sensor 1,2,3)	X			n.a.	Open loop on Sensor line detected. **PT100 open circuit** Suggested action: • Check Sensor wiring for open circuit
Start Limitation	X			Actual number of starts within the specified time interval has exceeded the parameterized Alarm level. **Number of starts per time limit**	Actual number of starts within the specified time interval has exceeded the parameterized Trip level. **Number of starts per time limit**

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
Autorestart Inhibit			X	Autorestart Inhibit is active (Input signal is activated to block Autorestart function).	n.a.
Star-Delta Transition Failed		X		n.a.	Dependent on changeover basis: "Current": • The actual current is not going below parameterized "Changeover Current" during Motor Startup Time • Contactor did not open during transition • Current measured during transition "Time": • Contactor did not open during transition • Current measured during transition
Actuator Both Limit Switches Active		X		n.a.	Both Limit switches activated at the same time Suggested action: • Check Limit Switch signals for Open and Close direction • Check Input Characteristic of Limit signals (NO/NC) • Check wiring
Actuator Torque Open		X		n.a.	Actuator running in open direction and Torque Open input was activated without Limit Open input was activated before. Suggested action: • Check Limit Open sensor and cabling • Check Input assignment

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
Actuator Torque Close		X		n.a.	Actuator running in open direction and Torque Close input was activated without Limit Close input was activated before. Suggested action: • Check Limit Close sensor and cabling • Check Input assignment • Torque close direction
Emergency Stop	X			n.a.	Emergency Stop activated
Earth Leakage	X			Calculated Earth Current I_O is higher than parameterized Alarm level. Suggested action: • Check parameter settings • Check Earthing system • Check motor or connected load	Calculated Earth Current I_O is higher than parameterized Trip level. Suggested action: • Check parameter settings • Check Earthing system • Check motor or connected load
Contact Temperature Unbalance		X		Difference between highest and lowest measured Contact Temperature T_{diff} is higher than parameterized Alarm level. Suggested action: • Check Power Module contacts • Investigate root cause for overheating • Check MNS Service Manual for further details	Difference between highest and lowest measured Contact Temperature T_{diff} is higher than parameterized Trip level. Suggested action: • Check Power Module contacts • Investigate root cause for overheating • Check MNS Service Manual for further details

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
Contact Temperature Supervision (L1,L2,L3)		X		Measured contact temperature **T** is higher than the parameterized Alarm level. Suggested action: • Check Power Module contacts • Investigate root cause for overheating • Check MNS Service Manual for details	Measured contact temperature **T** is higher than the parameterized Trip level. Suggested action: • Check Power Module contacts • Investigate root cause for overheating • Check MNS Service Manual for details
Fuse Supervision (L1,L2,L3)		X		n.a.	One of the fuses blown Suggested action: • Check fuses • Investigate root cause for blown fuse
Switch Cycle Supervision (K1,K2,K3)		X		Number of switching cycles for contactor K1 / K2 / K3 has exceeded the parameterized Alarm level Suggested action: • Module maintenance Note: To reset the Alarm message: • Increase the parameter value • Download parameters to M*Control*	n.a.

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
Operating Hours	X			Number of motor operating hours has exceeded the parameterized Alarm level Suggested action: • Module maintenance Note: To reset the Alarm message: • increase the parameter value • Download Parameter to M*Control*	n.a.
Insertion Cycle Supervision M*Start*		X		Number of Power Module insertion cycles is higher than parameterized Alarm level Suggested action: • Power Module maintenance • Check MNS Service Manual for details	n.a.
IRF Hardware (alternative 1) NOTE: This message is generated due to internal hardware house keeping tasks within the MNS *i*S System			X	n.a.	**Incorrect Application Download** Should an application be utilized requiring an Extended I/O card, AIAO, PTC, DI/DO and that application downloaded to an M*Control* without the extended I/O card present, the M*Control* will issue the IRF Hardware Trip. Suggested action: • Ensure that the correct firmware application and the correct MControl hardware are utilised.

Message	Relates to			Alarm condition	Trip condition
	Motor	Starter	System		
IRF Hardware (alternative 2) NOTE: This message is generated due to internal hardware house keeping tasks within the MNS *i*S System			X	n.a.	**PTC Load Not Connected** Should the PTC application be selected and enabled and no field wiring or load connected to the PTC terminals, the M*Control* will issue the IRF Hardware Trip. Suggested action: • Connect the required PTC field wiring
IRF Hardware (alternative 3) NOTE: This message is generated due to internal hardware house keeping tasks within the MNS *i*S System		X		n.a.	**Internal Hardware Error MStart** The M*Start* modules constantly perform house keeping checks. Should M*Start* detect an internal hardware problem, this information is then relayed to the M*Control*. The M*Control* will issue the IRF Hardware Trip. Suggested action: • This M*Start* related trip may clear if the M*Start* is withdrawn and re-inserted. • Should the problem persist please replace the M*Start*.

4 Technical Data

4.1 Control and Communication components

	MStart	MControl	MLink	MView
Electrical Data				
Auxiliary supply voltage(s)				
Supply voltage	24 VDC	24 VDC	24 VDC	24 VDC
Voltage range	19 – 31 VDC	19 – 31 VDC	19 – 31 VDC	19 – 31 VDC
Power consumption				
Typical	200 mA	150 mA	1000 mA	1200 mA
Maximum	240 mA	270 mA	1700 mA	1500 mA
Mechanical Data				
Dimensions (HxWxD) mm	Depending on starter type	125x53x260	110x265x230	247x185x82
Weight	Depending on starter type	0.7 kg	2.0 kg	5.0 kg
Environmental conditions				
Storage temperature	-20 …+70°C	-20 …+70°C	-20 …+70°C	- 20 … 60°C
Operation temperature	-5 … +55°C	-5 … +55°C	0 … +55°C	0 … +40°C *
Degree of protection	IP20	IP20	IP20	IP20
Reliability				
MTBF (Meantime between failures) at 40°C	48 years	19 years	15 years	8 years
	In combination: 13 years			

* Max. operation temperature for MView display (switchgear room temperature)

In-/ Output connection on M*Control* front				
	Input (optical isolated, one common)	**Output (two outputs share one common)**		
Over voltage class	II	II		
Pollution severity	3	3		
Nominal voltage	24 VDC	250 VAC 50/60 Hz		
Impulse voltage withstand level	0.33 kV	2.5 kV		
Nominal current (cosphi 0.4)	10 mA (16mA)	1 A		
Nominal cross-section of connector	1.5 mm^2	1.5 mm^2		
Minimum operations		5 * 10^6 mechanical 3 * 10^4 electrical		
Max switching voltage		230V AC	230 VDC	24 VDC
Max switching current		1 A	150 mA	6 A
Max switching capacity		500 VA		

4.2 Certificates

Low Voltage Switchgear		
Standard	**Subject**	**Note**
IEC 61439-1	Low voltage switchgear and controlgear assemblies – General rules	Verified Design in accordance with standard
IEC 61439-2	Low voltage switchgear and controlgear assemblies – Power switchgear and controlgear assemblies	Verified Design in accordance with standard
IEC/EN 60947-1	Low voltage switchgear and controlgear – General rules	
IEC/EN 60947-4-1	Low voltage switchgear and controlgear – Contactors and motor-starters – Electromechanical contactors and motor-starters	

Electromagnetic Compatibility		
Standard	**Subject**	**Performance Criterion**
EN 55011	Radio Interference Voltage	Level A
EN 55011	Radio Interference Field Strength	Level A
IEC 61000-6-2	Electromagnetic compatibility (EMC) – Generic standard – Immunity for industrial environments	Criteria for applications in industrial environment are met or even exceeded, see following results of IEC 61000-4-x
IEC 61000-4-2	Electrostatic Discharge - Contact Discharge - Air Discharge	 Level A Level A
IEC 61000-4-3	Radiation	Level A
IEC 61000-4-4	Burst	Level A
IEC 61000-4-5	Surge	Level A
IEC 61000-4-6	Inlet	Level A
IEC 61000-4-8	Power Frequency magnetic field	Level A
IEC 61000-4-11	Voltage Dips 230 V	Not applicable, for power supply only

5 Annex

5.1 Related Documentation

Document	Publication Number
MNS *i*S System Guide	1TGC910001B0204
MNS *i*S Interface Manual M*Link* - Release 6.0	1TGC910129M0201
MNS *i*S Interface Manual Web Interface - Release 6.0	1TGC910139M0201
MNS *i*S Interface Manual OPC Server - Release 6.0	1TGC910149M0201
MNS *i*S Interface Manual Profibus - Release 6.0	1TGC910159M0201
MNS *i*S M*Control* Interface Manual Profibus Direct – Release 6.0	1TGC910189M0201
MNS *i*S Interface Manual Modbus - Release 6.0	1TGC910169M0201
MNS *i*S M*Control* Interface Manual Profinet IO – Release 6.0	1TGC910191M0201
MNS *i*S Dual Redundancy Manual – Release 6.0	1TGC910179M0201
MNS *i*S M*Connect* Interface Manual – Release 6.0	1TGC910180M0201
MNS *i*S M*Navigate* Help file V6.0	1TGC910083M0201

5.2 Terminology

Abbreviation	Term	Description
	Aspect Object	ABB technology. An Aspect Object is a computer representation of a real object such as a pump, a valve, an order or a virtual object such as a service or an object type. An Aspect Object is described by its aspects and is organized in structures.
	Alarm	Alarm is defined as status transition from any state to abnormal state. Status transition to abnormal state can be data crossing over the pre-defined alarm limit.
	Bus Local	A Control Access term describing that the M*Control* accepts its commands from a device on the switchgear control network, e.g. the Web Interface, M*View*.
COTS	Commercial off the shelf	Commercial off the shelf product, term to describe products available on the market, ready to use.
DCS	Distributed Control System	See also PCS
DTM	Device Type Manager	Software module used to manage devices via fieldbus (e.g. PROFIBUS) using frame application environment (e.g. PactWare, ABB Fieldbus Builder etc.)

Abbreviation	Term	Description
Eth.	Ethernet	Ethernet is a local area network (LAN) technology. The Ethernet standard specifies the physical medium, access control rules and the message frames.
	Event	An event is a status transition from one state to another. It can be defined as alarm, if the state is defined as abnormal or as warning as a pre-alarm state.
FBP	FieldBusPlug	ABB technology for exchangeable fieldbus interface on intelligent field devices (e.g. transmitter, simple motor starter)
FD	Field Device	Term for devices connected to the fieldbus (e.g. motor control units or circuit breaker protection)
GSD file	Geräte Stamm Datei (German abbreviation)	Hardware description file for a PROFIBUS-DP or PROFIBUS-DP/V1 slave type
GPS	Global Positioning System	System to detect local position, universal time and time zone, GPS technology provides accurate time to a system
HMI	Human Machine Interface	Generic expression
LVS	Low voltage switchgear	A factory built assembly built to conform with IEC 60439-1
MCC	Motor Control Centre	Common term for a switchgear used for motor control and protection.
MNS		The Modular Low Voltage Switchgear family from ABB
MNS *i*S		The integrated intelligent switchgear solution from ABB
	M*Start* M*Feed* M*Control* M*Link* M*View* M*Navigate*	MNS *i*S components integrated in the switchgear, see the MNS *i*S System Guide for technical details
	MODBUS	Fieldbus communication protocol
	MODBUS RTU	Fieldbus communication protocol
	Motor Starter	Consists of motor controller and electrical components to control and protect a motor, part of Motor Control Center.
NLS	Native Language Support	Providing the ability to change the language of software tools in order to support native languages (English is basis, others are optional)
OPC		OLE for Process Control, an industrial standard for exchange of information between components and process control application

Abbreviation	Term	Description
PCS	Process Control System	High level process control system
PLC	Programmable Local Controller	Low level control unit
	PROFIBUS-DP	Fieldbus communication protocol with cyclic data transfer (V0).
	PROFIBUS-DP/V1	Fieldbus communication protocol, extension of PROFIBUS-DP allowing acyclic data transfer and multi master (V1).
	PROFIBUS-DP/V2	Fieldbus communication protocol, extension of PROFIBUS-DP allowing time stamp and communication between master and slave (V2).
RCU	Remote Control Unit	Local control unit with pushbutton and indicator to operate a device (e.g. motor) from field level
RS232		Standard No. 232 for PC communication, established by EIA (Electronics Industries Association, USA)
RS485		Communication interface standard from EIA (Electronics Industries Association, USA), operating on voltages between 0V and +5V. RS-485 is more noise resistant than RS-232C, handles data transmission over longer distances, and can drive more receivers
RTC	Real Time Clock	Integrated clock function in devices used to generate time and date information if a remote clock system is not present
	Software Local	A Control Access term describing that the M*Control* accepts its commands from the hardwired inputs as a result of either the PCS or M*View* passing the Control Access Authority to Soft-Local. Note: Does not require the hardwired local input to be set to true.
SNTP	Simple Network Time Protocol	A protocol used for time synchronization in Control Network through Ethernet
	Switchgear Bus Network	Term used to describe the internal switchgear communication network, between M*Link* and M*Control*
TCP/IP	Transmission Control Protocol / Internet Protocol	TCP/IP is a high-level connection oriented, reliable, full duplex communication protocol developed for integration of the heterogenous systems.

Abbreviation	Term	Description
	Trip	A consequence of an alarm activated or an external trip command from another device to stop the motor or trip the circuit breaker.
UTC	Coordinated Universal Time	Coordinated Universal Time is the international time standard. It is the current term for what was commonly referred to as Greenwich Meridian Time (GMT). Zero (0) hours UTC is midnight in Greenwich England, which lies on the zero longitudinal meridian. Universal time is based on a 24 hour clock.
	Warning	A warning is defined as status transition from any state to pre-alarm state to inform in advance before an alarm level is reached.

Contact us

ABB Low Voltage Systems
Publication Editor:
ABB Automation Products GmbH
Ladenburg, Germany

Publication No.
1TGC910809M0202

Local Contacts on
www.abb.com/mns

Power and productivity
for a better world™