MNS *i*S Motor Control Center
Interface Manual Profibus
System Release V7.0

Power and productivity
for a better world™

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This document relates to the MNS *i*S System Release 7.0.

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Table of content

General

Target Group

This document describes communication and control interfaces used in MNS *i*S.

The manual is primarily intended for those requiring information on accessing information and data provided from MNS *i*S. Furthermore the document provides information for integration of MNS *i*S as Fieldbus component into PLC or higher level Process Control Systems to control system and application engineers.

It is assumed that the reader of this manual is familiar with basic terms of Fieldbus and control communication (e.g. basic knowledge about PROFIBUS, Modbus etc.).

Use of Warning, Caution, Information and Tip icon

This publication includes **Warning**, **Caution**, and **Information** icons where appropriate to point out safety related or other important information. It also includes **Tip** icons to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

The electrical warning icon indicates the presence of a hazard that could result in *electrical shock.*

The warning icon indicates the presence of a hazard that could result in *personal injury.*

The caution icon indicates important information or warnings related to the concept discussed in the text. It might indicate the presence of a hazard that could result in *corruption of software or damage to equipment/property.*

The information icon alerts the reader to pertinent facts and conditions.

The tip icon indicates advice on, for example, how to design your project or how to use a certain function

Although **Warning** notices are related to personal injury, and **Caution** notices are associated with equipment or property damage, it should be understood that the operation of damaged equipment could, under certain operational conditions, result in impaired process performance leading to personal injury or death. It is, therefore, imperative that you comply fully with all **Warning** and **Caution** notices.

Terminology

List of the terms, acronyms, abbreviations and definitions that the document uses.

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.)
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.
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)	A 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
	Hardware Local	A Control Access term describing that the M*Control* accepts its commands from the Hardwired inputs, when the respective Local control input is set to true.

Abbreviation	Term	Description
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 switchgear used for motor control and protection.
MNS		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
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).

Abbreviation	Term	Description
	PROFIBUS-DP/V2	Fieldbus communication protocol, extension of PROFIBUS-DP allowing time stamp and communication between master and slave (V2).
	PROFINET	PROFINET is an open standard for Industrial Ethernet and standardized in IEC 61158 and IEC 61784.
PNIO	PROFINET IO	PROFINET for decentralized periphery and distributed automation
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.
	Trip	A consequence of an alarm activated or an external trip command from another device to stop the motor or trip the circuit breaker.

Abbreviation	Term	Description
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.

Related Documentation

MNS *i*S

1TGC910211 M0201 MNS *i*S Interface Manual M*Link*, Release 7.0

1TGC910111 M0201 MNS *i*S M*Link* Upgrade Kit Manual

1TGC910221 M0201 MNS *i*S Interface Manual Web Interface, Release 7.0

1TGC910231 M0201 MNS *i*S Interface Manual OPC Server, Release 7.0

1TGC910251 M0201 MNS *i*S Interface Manual Modbus, Release 7.0

1TGC910291 M0201 MNS *i*S Interface Manual PROFINET IO, Release 7.0

1TGC910281 M0201 MNS *i*S M*Control* Interface Manual Profibus Direct, Release 7.0

1TGC910261 M0201 MNS *i*S Interface Manual Redundancy, Release 7.0

1TGC910271 M0201 MNS iS M*Connect* Interface Manual, Release 7.0

1TGC910001 B0204 MNS *i*S System Guide

1TGC910201 M0201 MNS *i*S Quick Guide Installation and System Setup, Release 7.0

1TGC910090 M0201 M*Navigate* Help file V7.0

1TGC910018 M0208 MNS *i*S ATEX – Enhancements for Safety

Profibus additional guidelines

[1] PROFIBUS Installation Guideline, Rev 4, Nov 2002,
Profibus Competence Center Manchester, UK

[2] PROFIBUS Profiles for Low Voltage Switchgear Devices (LVSG),
3.122 Version 1.2 July 2006, PNO Karlsruhe, Germany

[3] PROFIBUS Installation Guideline for Cabling and Assembly,
8.022 Version 1.0.6 May 2006, PNO Karlsruhe, Germany

[4] PROFIBUS Installation Guideline for Commissioning
8.032 Version 1.0.2 November 2006 PNO Karlsruhe, Germany

[5] PROFIBUS Technology Description
4.002 Version October 2002 PNO Karlsruhe, Germany

Related System Version

The content of this document is related to MNS *i*S System Release 7.0.

The described functions are designed but may not be fully implemented in all details. Please refer to the current system guides and release notes regarding possible restrictions.

Document Revision History

Introduction

Profibus Standard

PROFIBUS is a manufacturer-independent Fieldbus standard for applications in manufacturing, process and building automation. PROFIBUS technology is described in fixed terms in DIN 19245 as a German standard and in EN 50170 / IEC 61158 as an international standard. The PROFIBUS standard is thus available to every provider of automation product.

The PROFIBUS family is composed of three types of protocol, each of which is used for different tasks. Of course, devices with all three protocols can communicate with each other in a complex system by means of a PROFIBUS network.

The three types of protocols are: PROFIBUS FMS, DP and PA. Only the two protocol types DP and PA are important for process automation, whereas only DP is used in MNS *i*S. See also reference document [5].

PROFIBUS DP: the **PRO**cess **Fi**eld**bus** for the **D**ecentralized **P**eriphery

The PROFIBUS DP (RS 485) is responsible for communication between the Controller level of a process automation system and the decentralized periphery in the field. One feature of PROFIBUS DP is its high speed of transmission up to 12 Mbit/s.

M*Link* supports transmission speed up to 1.5 Mbit/s only.

MNS iS Software Requirements

For full support of the MNS *i*S V7.0 functionality the Profibus interface requires

- M*Link* image 1TGE131013R0001 or higher
- M*Navigate* Version 7.0 or higher

Basics

PROFIBUS DP-V0

Cyclic Data Communication

The data communication between the DPM1 (DP Master Class 1) and its assigned slaves is automatically handled by the DPM1 in a defined, recurring sequence. With each user data transfer, the master can write up to 244 bytes of output data to the slave and read up to 244 bytes of input data from the slave. The Data is read and written synchronously in one procedure.

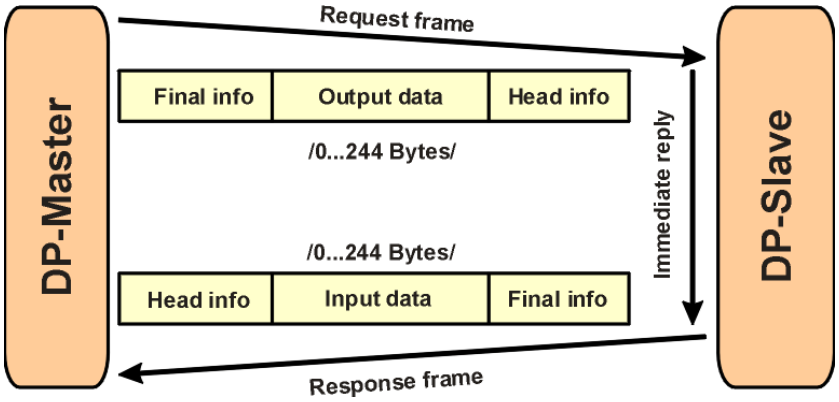


Fig. 1 Cyclic User Data Transmission in DP

The data communication between the DPM1 and the slaves is divided into three phases: parameterization, configuration and data transfer. Before the master includes a DP slave in the data transfer phase, a check is run during the parameterization and configuration phase to ensure that the configured set point configuration matches the actual device configuration. During this check, the device type, format and length information and the number of inputs and outputs must also correspond. This provides you with reliable protection against parameterization errors.

Diagnostics

In addition to the cyclic data the PROFIBUS slave unit provides diagnostic data. With this diagnostic data the slave can indicate errors or warnings on the slave unit, the I/O-units or the I/O-channels. Some diagnostic data is generic and defined by the PNO. But most of the diagnostic data is manufacturer specific.

An example for generic diagnosis is: Slave not ready, Parameter fault and Watchdog monitoring.

M*Link* does support only generic diagnostic.
Extended (manufacturer specific) diagnostic is not used.

Sync and Freeze Mode

In addition to the normal cyclic communication between the DPM1 (DP Master Class 1) and the assigned slaves, a master can send the control commands sync and freeze via multicast to a group of slaves.

With the sync-command the addressed slaves will freeze the outputs in their current state. New output values received by the master will be stored while the output states remain unchanged. The stored output data are not sent to the outputs until the next sync command is received. The Sync mode is terminated with the “unsync” command.

In the same way, a freeze command causes the addressed slaves to enter freeze mode. In this mode, the states of the inputs are frozen at their current value. The input data are not updated again until the master sends the next freeze command. Freeze mode is terminated with the “unfreeze” command

M*Link* does not support Sync Mode and Freeze Mode even is it is selectable in GSD configuration..

DP Master Class 1 (DPM1) and Class 2 (DPM2)

The DP master class 1 is the master that is in cyclic data transmission with the assigned slaves. To get into the cyclic communication the DPM1 has to configure the slave before.

The DP master class 2 is used for engineering and configuration. It does not have cyclic data transmission with the slave devices. Normally a DPM2 is only connected temporarily to the bus. A DPM2 can have class 2 communication to the slave devices before the slaves are configured via DPM1 and cyclic communication is active.

M*Link* supports communication with DPM1 only.

Monitoring the DP-V0 Communication

The cyclic communication between the DPM1 and the slaves is monitored by the master and the slaves itself. If the DPM master unit detects a failure in the communication with a slave, it will indicate the corresponding slave as disturbed.

On slave side the communication with the master is controlled via the watchdog. If no data communication with the master occurs within the watchdog control interval, the slave automatically switches its outputs to the fail-safe state.

PROFIBUS watchdog must be enabled for master and failsafe functionality must be parameterized for M*Link*.

PROFIBUS DP-V1

Acyclic Data Communication

The key feature of version DP-V1 is the extended function for acyclic data communication. The acyclic data communication is mainly used for configuration and parameterization purpose. With the acyclic DP-V1 read and write services the master can read or write any desired data to and from the slave. The data is addressed by slot, index and length. Each data block can be up to 240 bytes.

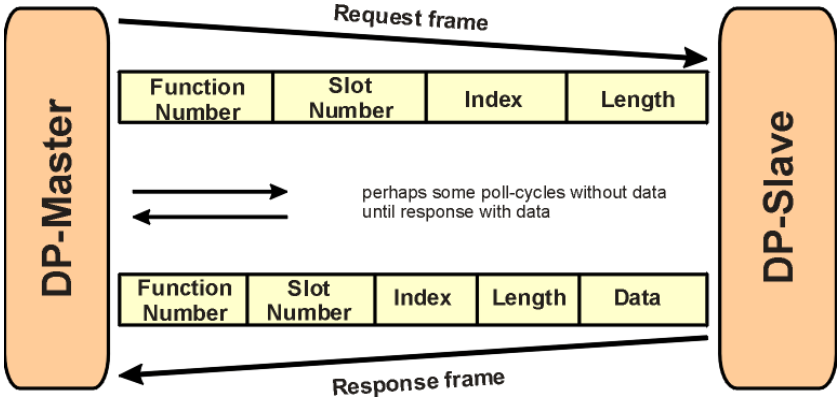


Fig. 2 Acyclic Communication in DP-V1: Read Service

The transmission of acyclic data is executed in parallel to the cyclic data communication, but with lower priority. Acyclic services are operated in the remaining time at the end of the DP-V0 cycle.

Interfaces

MLink connectors

M*Link* provides the facility to connect MNS *i*S on a single entry point to a process control system (PLC or PCS) via PROFIBUS. Depending on the PLC application M*Link* can support PROFIBUS DP (-V0) and PROFIBUS DP-V1. M*Link* acts as a standard PROFIBUS Slave device.

For details see corresponding MNS iS Interface Manual MLink, see section References hereunder.

MLink Redundancy

The M*Link* is available for both single and redundant configurations. The Profibus communication protocol is the same in both configurations.

In a redundant configuration two M*Link*s are used. They are connected together via port Serial 1 for internal data exchange / synchronization. One M*Link* is configured as 'Primary' M*Link* and the second M*Link* is configured as 'Backup' M*Link*. In case of a system disturbance where communication is lost to the 'Primary', the M*Links* will automatically initiate a transfer from Primary to Backup.

Refer to the manual MNS i*S* Interface Manuals Redundancy, see section References hereunder.

References

Hardware ID numbers	**1TGE1020x9Rxxxx**	**1TGE120021R0110**
MLink Types		
Hardware available for MNS iS Versions	up to V6.0	from V6.1 onwards
MNS iS Interface Manual **MLink**	1TGC 91012x M020x	1TGC 91021x M020x
MNS iS Interface Manual **Dual Redundancy**	1TGC 9102 60M020x	

Connection

The physical medium for PROFIBUS-DP is RS-485, which allows 32 nodes in a single segment and 125 nodes in a network using 4 segments. Segments must be separated by using Repeater.

The PROFIBUS interface checks input signal for poll requests from master and detects automatically requested baud rate. It is able to work with baud rates up to 1.5M.

Cable length may vary from 80-1200 m depending on transmission speed and repeater type in use. Cable length can be extended using fiber optic modems (yielding a more robust network). See reference document [4] for more details on cable connections and wiring.

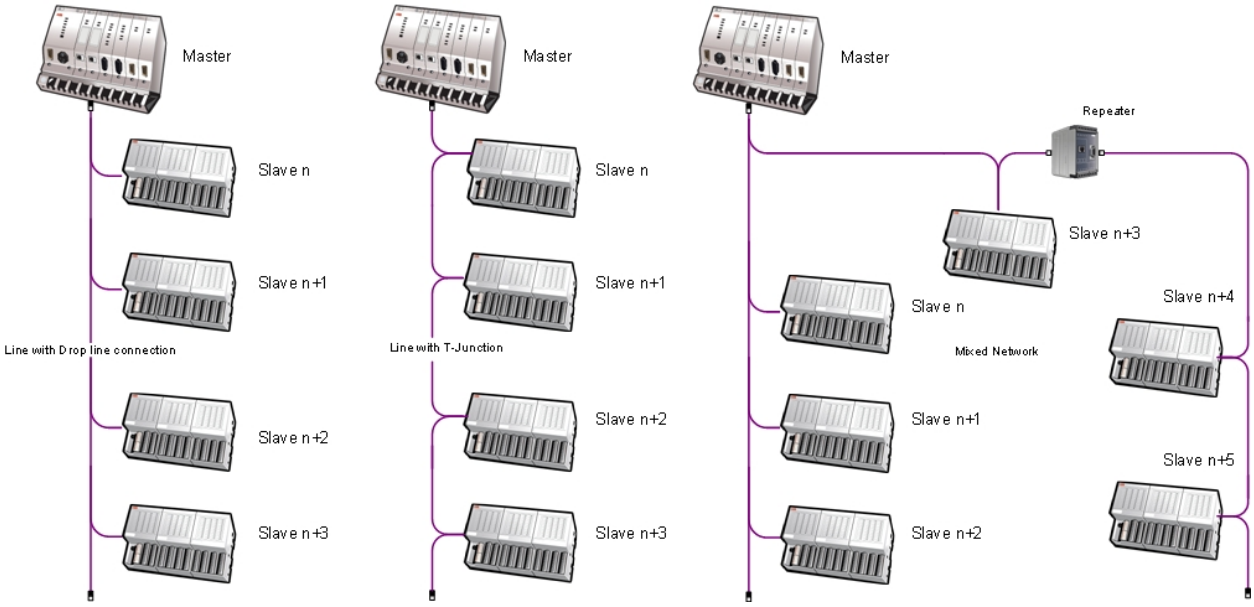


Fig. 3 PROFIBUS network principles

In a mixed network, the maximum cable length of drop lines must be considered, also the max communication speed is less than 1.5 MBaud. See reference documents 1 & 3 for more information.

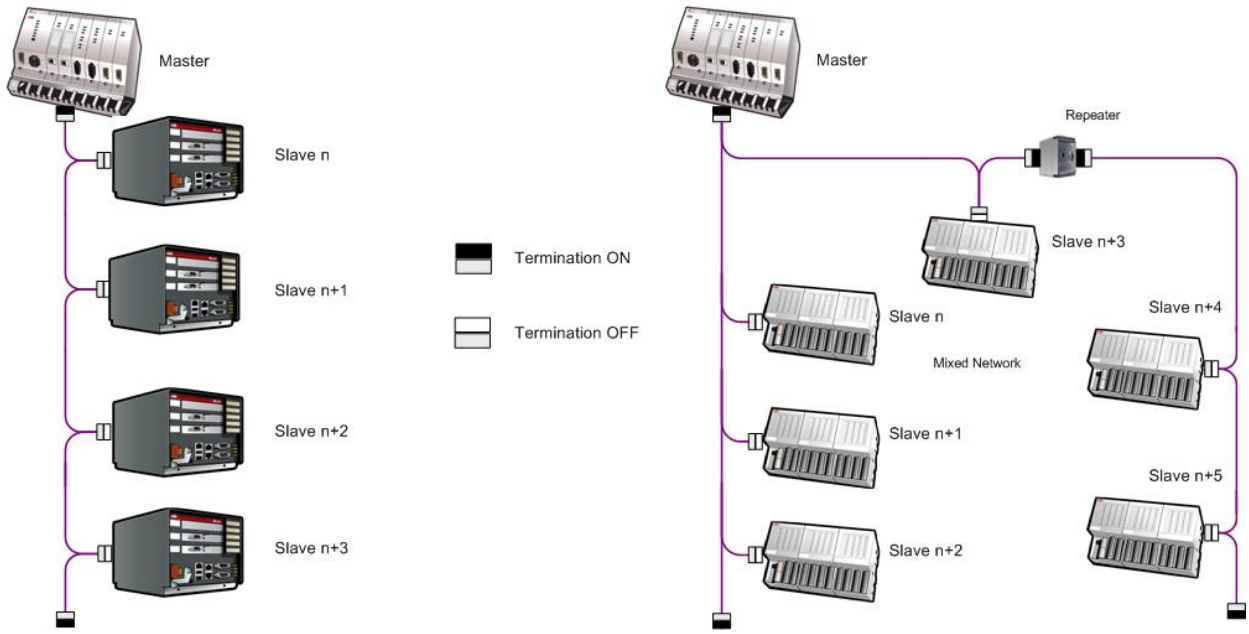
Termination

The connection to the M*Link* is achieved via a Profibus Standard Sub-D connector. In all Profibus networks care must be taken that each end of a segment is terminated correctly termination must be activated. The M*Link* does not provide PROFIBUS Termination, the recommended method of termination is to utilize the termination switches of the standard D-types. .

It is recommended to use PROFIBUS standard plugs with Termination inbuilt. Depending on the location in the segment, the Termination must be on or off (see figures 5 and 6).

M*Link* connection and termination examples

Fig. 4 M*Link* PROFIBUS connection and termination examples



Getting Started

M*Link* requires following configuration parameters in order communicate correctly in PROFIBUS network.

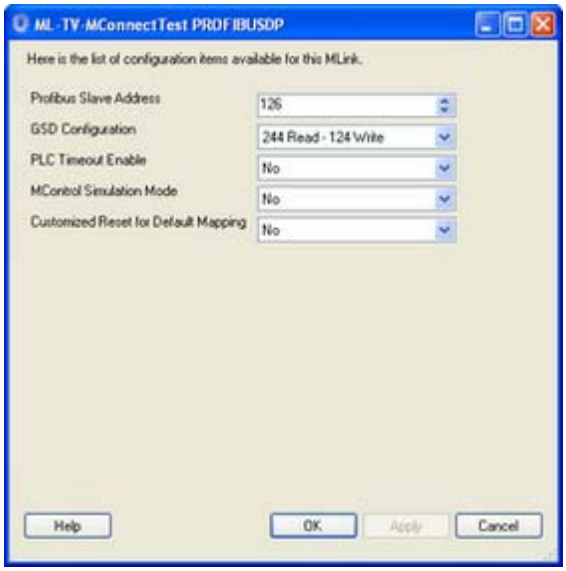
Initial Values

Parameter	Default Value	Range	Remarks
Profibus Slave Address	126	3 …125	PROFIBUS station address (0, 1 reserved for DP Master, 126, 127 reserved)
GSD Configuration	244 read - 124 write	244 read - 124 write 120 read - 60 write 32 read - 16 write	Selects the data length module definition from the GSD file
PLC Timeout Enable	No	Yes, No	Activates PLC Time Out parameter
PLC Timeout	10	1 … 120 seconds	Time delay (+ PROFIBUS watchdog time) until Failsafe execution
MControl Simulation Mode	No	Yes, No	Enables M*Link* to run in simulation mode
Customized Reset for Default Mapping	No	Yes, No	Customized Trip Reset is used instead of Trip Reset All (for Default Mapping only)

Table 1 PROFIBUS initial values and parameters

Parameters must first of all be configured with M*Navigate.* After download of the above parameters M*Link* the settings will become active.

Fig. 6 Parameter Window for PROFIBUS parameter in M*Navigate*



Please Note:

The default setting for ‘PLC Timeout Enable’ is No

Therefore ‘PLC Timeout’ interval is hidden, this becomes visible when Yes is selected.

Addressing

PROFIBUS DP allows the address range of 0 to 127. Following reservations apply:

0, 1 - reserved; used for PROFIBUS Master

2 - reserved; PROFIBUS MLink address during re-boot only

126, 127 - reserved

Above reserved addresses must not be used for PROFIBUS M*Link* or any other slave device in the network. All other addresses are available for free use.

It must be ensured that the selected address is unique in a network connected to the PROFIBUS Master. Double addressing in the network will cause communication errors on PROFIBUS.

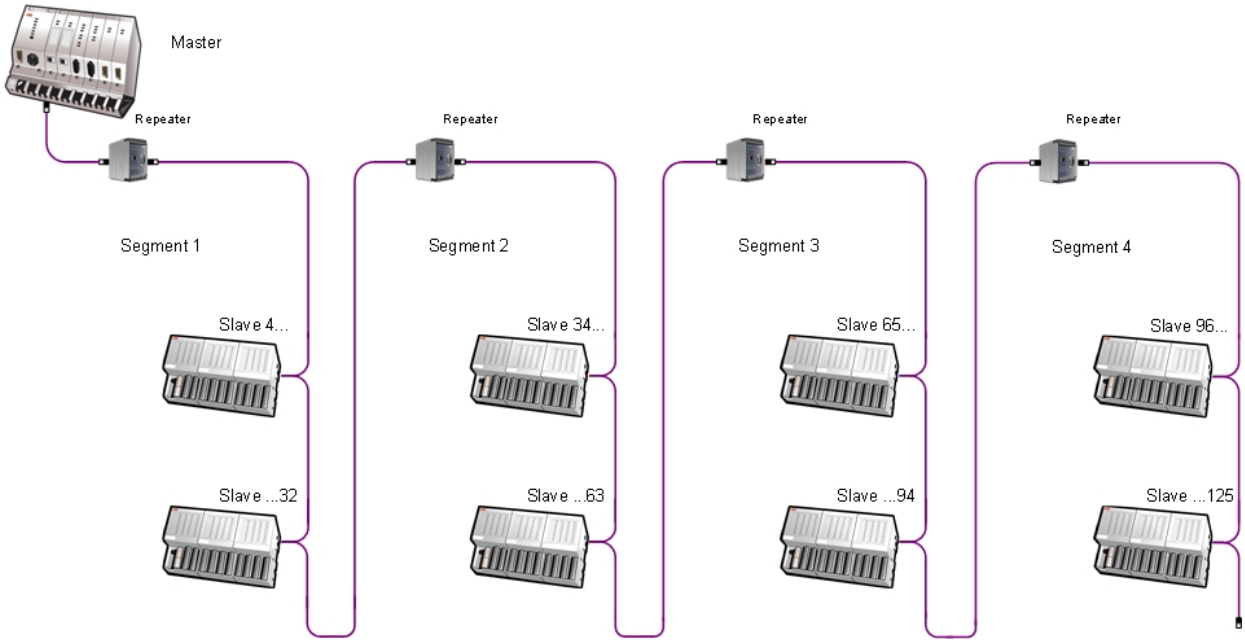
It is recommended to set the Highest Station Address (HSA) in the *Profibus Master* to 125 to be able to add new Slave devices (which have default address of 126) without a disturbance of the Profibus communication.

The M*Link* does not support address setting / editing from the PROFIBUS Master. The address must be defined with the M*Link* parameter ”Profibus Slave Address“ (please refer to Table 1).

Editing / re-parameterization of the MLink Profinet slave then downloading of the parameters from M*Navigate* will cause a restart of the M*Link's* internal PROFIBUS application program with the new slave address.

If more than 32 devices are connected to a segment, repeater devices have to be used. Such repeater counts as one Slave within a segment without using an address number. Thus only 30 Slaves are possible within a segment.

Fig. 7 Example of max address range and slave numbers on one PROFIBUS Master



MControl Module Selection (GSD File)

The M*Link* enables communication to a maximum of 60 M*Controls*. This data is available in a default data map selected from M*Navigate* with “244 read – 124 write” bytes of data. This GSD file (ID: 0x09C6) is readily available from ABB.

If in special cases a lower number of M*Control* are connected per M*Link*, another module can be selected in the GSD file supporting only 30 or 8 M*Control* per M*Link* (see chapter Initial Values).

This selection is done in the PLC, however, it must be correctly set in the M*Link* parameter (with M*Navigate*) to support different modules.

MControl Simulation

M*Control* Simulation function allows setting M*Link* into a simulation mode without requiring connection of the M*Control* modules.

This function can be used for communication tests between any PROFIBUS Master and M*Link*.

The function simulates 60 motor starters. Each motor can be controlled via PROFIBUS by Run Forward, Run Reverse or Stop command. The actual motor status is shown by the PROFIBUS motor status. If the motor was started with "Run Forward” motor current ramps up from 85...100.5% and back to 85%. In case of "Run Reverse" the current is all the time 90%.

This simulation is also supported with the reduced Default Data Mapping for 30 or 8 M*Controls*. It is not supported for User Configured data mapping.

Failsafe

To ensure that operational and / or safety requirements are met in the event on an interruption in communication loss between the Profibus master and the M*Link*, MNS iS provides the possibility to select a condition to meet these requirements.

The timeout for this event is set by using of watchdog time in the DP master class 1 (DPM1) and the parameter ‘PLC Time Out Enable’ is set with M*Navigate* to ‘Yes’ and a ‘PLC Timeout’ must then be defined. Please refer to Table 1 for more information.

The required condition for the motor must then be set in the ‘Starter Function’ application within M*Navigate*, conditions vary with respect to which Starter Function is utilized, however the basic conditions remain the same :

NOP No Operation, the motor remains in it’s current state.

Stop If the motor was ‘running’ condition when the Failsafe event occurred, then it is Stopped.

Start If the motor was in the ‘available’ condition when the Failsafe event occurred, then it is Started.

PROFIBUS Data Mapping

Two possibilities exist for data mapping, the default data map as described below, based upon the PNO profile [2] and a user defined data map which can be created by the MNS *iS* Mapping Tool.

User Data Mapping

All available data in a M*Control* application can be assigned to the corresponding register addresses by using the MNS *i*S Mapping Tool. The Mapping Tool is a proprietary tool for ABB to program and modify the PROFIBUS registers according to customer requirements.

The customized mapping is accessible through M*Navigate* and a report can be printed and handed to DCS for data and application programming (see M*Navigate* help files for details).

Details for data available for customized mapping are available on request from ABB.

If there is a communication interruption between a MControl/MConnect (e.g. device removed) and the related MLink then the information configured in the mapping for this device will show the last values before the interruption.

At the same time the Life Bit for this device, which shall be always part of a User Mapping, is cleared to 0 (1 is indicating device is communicating).

This Life Bit information for each configured device shall be used in DCS to validate the Read-Data from the device. An Alarm shall be raise if Life Bit value becomes “0” to indicate that the communication to that single device is disturbed and no remote control of the connected motor/load is possible any longer.

Default Data Mapping

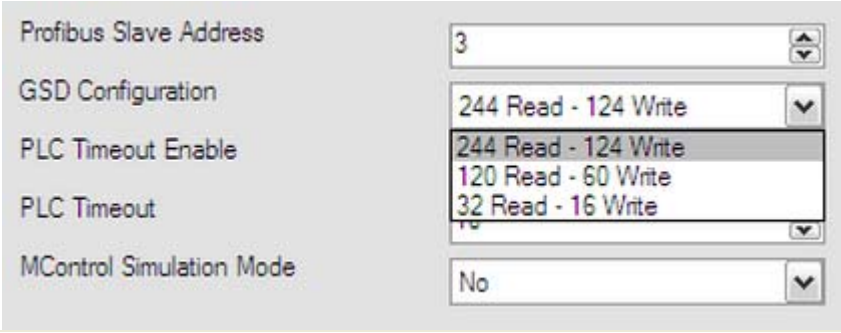
Through the default PROFIBUS data map up to a maximum of 60 M*Control* are provided. Alternatively modules with different data length (including 30 or 8 M*Control*) can be selected by parameter GSD Configuration and by GSD file. Process operation data are sent and received through cyclic DP communication, while the acyclic communication is used to send additional information for system status and maintenance.

If Profibus Default Mapping is configured and a communication interruption between a MControl/MConnect (e.g. device removed) and the related MLink occurs then all information configured in the mapping for this device will be cleared to “0”.

At the same time the Life Bit for this device (always part of Default Mapping) is cleared to 0 (1 is indicating device is communicating).

This Life Bit information for each configured device shall be used in DCS to validate the Read-Data from the device. An Alarm shall be raise if Life Bit value becomes “0” to indicate that the communication to that single device is disturbed and no remote control of the connected motor/load is possible any longer.

Mapping Selection from M*Navigate*



The dialog box highlights the options supported for the standard GSD Configuration.

The default setting being 244 Read, 124 Write, the standard options are listed below.

- 244 Read - 124 Write enables communication with 60 M*Controls*
- 120 Read - 60 Write enables communication with 30 M*Controls*
- 32 Read - 16 Write enables communication with 8 M*Controls*

Cyclic Data Communication (DP-V0)

Monitoring (Inputs from field device to master, class 1)

This section deals with the information that is read from the MLink by the Profibus Master.

Table 2 244 Byte cyclic Data Structure

Byte	Monitoring data of
0..3	M*Control* 1
4..7	M*Control* 2
…	…
236..239	M*Control* 60
240..243	Reserved

Table 3 Monitoring Data Structure of a single M*Control* motor starter NR-DOL; Data layout based upon PNO Profile [2]

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	Overload Warning	Run Forward	Off	reserved
1	Life Bit	Ready	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Motor current phase L1 – high [% / In]							
3	Motor current phase L1 – low [% / In]							

Table 4 Monitoring Data Structure of a single M*Control* motor starter REV-DOL; Data layout based on PNO Profile [2]

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	Overload Warning	Run Forward	Off	Run Reverse
1	Life Bit	Ready	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Motor current phase L1 – high [% / In]							
3	Motor current phase L1 – low [% / In]							

Table 5 Monitoring Data Structure of a single M*Control* motor starter STAR/DELTA, Data layout bases on PNO Profile [2]

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	Overload Warning	Runs	Off	reserved
1	Life Bit	Ready	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Motor current phase L1 – high [% / In]							
3	Motor current phase L1 – low [% / In]							
	Bit 2 is set when the motor is running in both Star and Delta. When the signal 'Motor Running Star' is required this can be separately mapped to one of the GPI's utilizing M*Navigate* and the function of 'Programmable Logic Register'.							

Table 6 Monitoring Data Structure of a single M*Control* motor starter NR-DOL-Soft Starter, Data layout bases on PNO Profile [2]

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	Overload Warning	Runs	Off	reserved
1	Life Bit	Ready	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Motor current phase L1 – high [% / In]							
3	Motor current phase L1 – low [% / In]							

Table 7 Monitoring Data Structure of a single M*Control* motor starter Actuator

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	Overload Warning	Runs Close	Off	Runs Open
1	Life Bit	Ready	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Motor current phase L1 – high [% / In]							
3	Motor current phase L1 – low [% / In]							
	Where open / closed indication is required this can be mapped to the GPI's utilizing M*Navigate* and the function of 'Programmable Logic Register and selecting the 'Actuator Closed' or 'Actuator Opened' function.							

Table 8 Monitoring Data Structure of a single M*Control* with Transparent types

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	GPI 8	Fault	Auto Mode	GPI 7	GPI 6	K1	K3	K2
1	Life Bit	Ready	Test	GPI 5	GPI 4	GPI 3	GPI 2	GPI 1
2	Motor current phase L1 – high [% / In]							
3	Motor current phase L1 – low [% / In]							

Note:
Bit 0: 1 = K2 closed 0 = K2 open
Bit 1: 1 = K3 closed 0 = K3 open
Bit 2: 1 = K1 closed 0 = K1 open

Table 9 Monitoring Data Structure of a CFeed, CFeed-RCU

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	reserved	On	Off	reserved
1	Life Bit	Ready	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Current phase L1 – high [% / In]							
3	Current phase L1 – low [% / In]							

Table 10 Monitoring Data Structure of an MFeed

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	reserved	On	Off	reserved
1	Life Bit	reserved	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	Current phase L1 – high [% / In]							
3	Current phase L1 – low [% / In]							

Table 11 Monitoring Data Structure of a DC- MFeed

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Warning	Fault	Auto Mode	reserved	reserved	On	Off	reserved
1	Life Bit	reserved	Test	Trip reset possible	reserved	GPI 3	GPI 2	GPI 1
2	DC Current in Percent – high [% / In]							
3	DC Current in Percent – low [% / In]							

Table 12 Monitoring Data Structure of a MConnect with Circuit breaker

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	L-Prealarm or L-Timing	Spring Charged	UV tripped	GPI1	00 = CB undefined or No Slave Communication 01 = Open 10 = Closed 11 = Any Trip		00 = Isolated 01 = Connected 10 = Test 11 = Not present (no modbus communication)	
1	CA Remote (*)	000 = no trip (Not (Any Trip or CB Trip)) 001 = L tripped (includes over current N phases) 010 = I tripped 011 = S tripped or S2 tripped 100 = G tripped or Gext tripped 101 = External Input Trip 110 = reserved 111 = Other trip			MConnect Life Bit	CA HW Local (*)	Any Alarm	GPI2
2	Breaker L1 Phase Current [A] – MSB							
3	Breaker L1 Phase Current [A] – LSB (value 65535 means not measured)							

(*) The CA Status reflects the MNSiS Control Access status. It is not related to the control mode (Local/Remote) of the Sace breaker itself !

Status Bit Explanation

Table 13 Explanation of synchronous data range, reading bytes (NR-DOL, REV-DOL)			
Byte 0 Bit 7	Warning	0 = no warning	1 = any warning of the available protection and supervision functions
Byte 0 Bit 6	Fault	0 = no trip condition	1 = any trip condition of the available protection and supervision functions
Byte 0 Bit 5	Auto Mode	0 = not in Remote Control; any local control station (hardwired to I/O on M*Control*) is allowed to send control command	1 = Remote Control; the DCS or any control station on the switchgear control network is allowed to send control command
Byte 0 Bit 4	reserved		
Byte 0 Bit 3	Overload Warning	0 = no Thermal Overload Warning (TOL) pending	1 = Thermal Overload Warning; set level for TOL is reached (i.e. 90%)
Byte 0 Bit 2	Run CW	0 = not running clockwise	1 = motor is running clockwise
Byte 0 Bit 1	Off	0 = motor is not stopped (= is running)	1 = motor stopped or tripped
Byte 0 Bit 0	Run CCW	0 = not running counter clockwise	1 = motor is running counter clockwise
Byte 1 Bit 7	Life Bit	0 = M*Control* is not available (not communicating) Note: No Remote control of the motor/load possible !	1 = M*Control* is available (communicating)
Byte 1 Bit 6	Ready	0 = not ready to start	1 = ready to start = M*Start* connected & main switch on & no trip & no start inhibit
Byte 1 Bit 5	Test	0 = M*Start* not in test position	1 = M*Start* in test position; Main switch off but contactor control possible
Byte 1 Bit 4	Trip Reset possible	0 = Trip reset not possible	1 = Trip reset possible
Byte 1 Bit 3	reserved		
Byte 1 Bit 2	GPI 3	0 = General Purpose Input 3 not active	1 = General Purpose Input 3 is active
Byte 1 Bit 1	GPI 2	0 = General Purpose Input 2 not active	1 = General Purpose Input 2 is active
Byte 1 Bit 0	GPI 1	0 = General Purpose Input 1 not active	1 = General Purpose Input 1 is active

Commands (Outputs to field device from master, class 1)

This section deals with the commands that are sent from the Profibus Master to the MLink.

Table 14 122 Byte cyclic Data Structure

Byte	Commands to
0..1	M*Control* 1
2..3	M*Control* 2
…	…
118..119	M*Control* 60
120..123	reserved for future use

Table 15 Command Data Structure of a Motor Starter NR-DOL and NR-Soft Starter, and Star/ Delta; Data layout bases on PNO Profile [2]

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	reserved	Run Forward	Off	reserved
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	reserved	reserved

Table 16 Command Data Structure of a Motor Starter REV-DOL; Data layout bases on PNO Profile [2]

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	reserved	Run Forward	Off	Run Reverse
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	reserved	reserved

Table 17 Command Data Structure of a Motor Starter Actuator

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	reserved	Run Close	Off	Run Open
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	reserved	reserved

Table 18 Command Data Structure of a TRANSPARENT starter / feeder

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	K1 Open	K1 Close	K3 Close	K2 Close
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	K3 Open	K2 Open

Table 19 Command Data Structure of a CFeed, CFeed-RCU

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	reserved	On	Off	reserved
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	reserved	reserved

Table 20 Command Data Structure of an M*Feed*

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	reserved	reserved	reserved	reserved
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	reserved	reserved

Table 21 Command Data Structure of a DC-M*Feed*

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	reserved	Trip reset	Auto Mode	reserved	reserved	reserved	reserved	reserved
1	GPO4	GPO3	GPO2	GPO1	Bus-Local	Soft-Local	reserved	reserved

Table 22 Command Data Structure of a MConnect with Circuit Breaker

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	GPO2	GPO1	Set CA Remote (*)	reserved	CB Reset	Trip Reset	00 = “NOP” command 01 = “CB Open” (modbus value = 8) 10 = “CB Close” (modbus value = 9) 11 = “NOP” command	
1	reserved	reserved	reserved	reserved	reserved	reserved	reserved	reserved

(*) CA Remote is the Control Access status in MNSiS system and is not the Remote status of the breaker ! That breaker Remote status can only be set at the breaker itself !

Note : Commands are executed only when respective command bit changes from 0 to 1 !

Handling of Commands and Priority

Command priority

- If the Off bit is set Run Forward and Run Reverse are ineffective.
  Off command has highest priority.
- If Run Forward and Run Reverse are set, both commands are ineffective.
  No command is send to M*Control*.
- GPOx commands are sent with lower priority, they should not be used for time critical operations.

Command execution

- Only one command per received PROFIBUS telegram is accepted from M*Control*
  (either Run or Stop or Trip Reset)
- The Auto Mode bit must be set to one in order to execute commands via Fieldbus from a DCS/PLC.
- Commands are only executed if command bit has changed from 0 to 1.

User mapping command execution

- Command execution order for the Profibus user mapping is from lowest (bit 0) to highest bit (bit 7), this means bit 0 has the highest priority.

Example of control bytes for Rev-Dol Motor Starter

Table 23 Explanation of synchronous data range writing Bytes		
Byte 0 Bit 7	reserved	
Byte 0 Bit 6	Trip Reset	1 = to reset any trip condition of the according motor starter (possible when “Trip Reset Possible” Byte 1/Bit 4 in monitoring data structure is set to 1)
Byte 0 Bit 5	Auto Mode	1 = Instructs M*Control* to accept control commands from remote location (PLC / PCS)
Byte 0 Bit 4	reserved	
Byte 0 Bit 3	reserved	
Byte 0 Bit 2	Run CW	1 = M*Control* will start motor ‘clockwise’
Byte 0 Bit 1	Off	1 = M*Control* will stop motor
Byte 0 Bit 0	Run CCW	1 = M*Control* will start motor ‘counter clockwise’
Byte 1 Bit 7	GPO4	1 = GPO4 is set, 0 = GPO4 is reset
Byte 1 Bit 6	GPO3	1 = GPO3 is set, 0 = GPO3 is reset
Byte 1 Bit 5	GPO2	1 = GPO2 is set, 0 = GPO2 is reset
Byte 1 Bit 4	GPO1	1 = GPO1 is set, 0 = GPO1 is reset
Byte 1 Bit 3	Bus-Local	1 = Control Access is passed to any control station on the switchgear control network (M*View* or Web Browser)
Byte 1 Bit 2	Soft-Local	1 = Control Access is passed to a local control station hardwired to I/O on M*Control*
Byte 1 Bit 1	reserved	
Byte 1 Bit 0	reserved	

Redundant MLink Profibus data

Additional data map is provided for a redundant data interface to determine the status of MLink (Primary/Backup, Redundancy Error). It is also possible to send commands to force a change-over.

Please refer to the Redundancy Manual for further details.

Table 24 Information that can be monitored by the Profibus master for Redundancy status

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
243	reserved	reserved	reserved	reserved	reserved	reserved	Redundancy Error	Primary

Bit 0 is set to indicate which MLink is currently set to Primary.

Bit 1 is set when there is a redundancy error, for example when 1 M*Link* is offline

Table 25 Redundancy Commands that can be sent from the Profibus master

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
123	reserved	reserved	reserved	reserved	reserved	reserved	reserved	Redundancy change-over

Bit 0 when this bit is sent to either the Primary or Backup MLink it initiates a change-over.

Control Access

Control Access (CA) is a mechanism within MNS *i*S to define and determine which user interface has control rights to operate the M*Start* or M*Feed* modules. These interfaces are defined below in command handling. Control Access rights can be given, for example, by a specific command sent to switch operation rights from push-button (hardwired to M*Control*) to any other interface connected via the M*Link* (e.g. M*View* or DCS).

Command Handling

The control access command defines the control rights of defined interfaces for an M*Control*.

Remote - M*Control* switches to Remote operation mode and can be operated via Fieldbus from process control system (DCS / PLC)

Bus-Local - M*Control* switches to the Bus-Local mode and operation is possible:

- via M*View* (local operation panel in switchboard) or
- via web interface (similar to M*View*).

Soft-Local - M*Control* switches to local mode, and operation is possible via the digital inputs on the M*Control.* Soft Local does not require a hardware input to be set. Soft-Local may only be activated by a command sent from the DCS or M*View*. It may also be configured directly in the M*Control* parameters.

Hardware-Local - M*Control* switches to the Hardware-Local mode and operation is possible only through digital inputs on M*Control* Hardware. Hardware-Local must be activated by the setting the input on the M*Contro*l

Table 26 Commands and status for Control Access (default map)

	Command	Command	Command	Status Bit
CA Interface	**Auto Mode (CA Remote)**	**Soft Local (CA SoftLocal)**	**Bus Local (CA BusLocal)**	**Auto Mode (Bus Control)**
DCS only	1	0	0	1
M*View* (Web interface)	0	0	1	1
Hardware Inputs (Hardware Local or Soft Local)	0	1	0	0
Hardware Local (Hardware Inputs)	X	X	X	0
	The Remote signal may be monitored / mapped by selecting the ‘CA Remote’ Input Signal in the parameterization options in M*Navigate*, it can then be utilized in conjunction with the ‘General Purpose Inputs’ of the M*Control*.			

Notes:

At any time any control station can obtain the control access by sending a control access command to M*Control*. On M*View* (or web interface) the user must have the appropriate user right to do so.

Hardware-Local must be activated by the setting the input on the M*Contro*l.

MControl will change to CA Remote if the command bit Auto Mode and a control command is set. Control commands are rising edge triggered.

Such control commands are for example Run Forward or Off. GPO commands are not related to CA Remote.

CA SoftLocal (or CA BusLocal) will be active if Auto Mode is not set and the Soft Local (or Bus Local) command bit goes from 0 to 1.

Hardware-Local overrides all other CA Levels. It is not possible for the DCS or MView to take control when the MControl is set to HW-Local.

The current active control station (Control Access Owner) can be identified by reading data through DP-V1 functionality, see Table 25.

Recommended procedure for sending control commands for a motor starter

1. Set the "Auto mode" bit to “1” and set the desired state, one of the bits "Run Reverse", "Off", "Run Forward" or "Trip Reset"
3. Wait until desired state is shown in motor state (received from Slave).
4. Reset previous set bit "Run Reverse", "Off", "Run Forward" or "Trip Reset"

The "Auto mode" should remain “1” as long as PROFIBUS master controls the motor starter.

Acyclic Data Communication (DP-V1 – master class 1)

The PROFIBUS DP-V1 function will provide additional asynchronous data transferred from each M*Control*. The data is listed in the tables below.

The DPV1 read request requires the following three parameters:

Slot number:

- M*Control* number (1… 60)

Index:

- Number of data set (see table below)

Length (defines data length):

- for MLink Hardware 1TGE120021R0110: Range 1… 240
- for MLink Hardware 1TGE1020x9R1001: Range 1… 56

Maximum 56 byte of data can be read in one cycle. The starting point in the table is defined with the index number; the length can be between 1 to 56 bytes.

Example 1:

Slot number = 8; Index number = 0; Length = 54
From MControl 8 the following data is read:

“Current Phase L1 [A]” until “Time to Trip [sec]”

Example 2:

Slot number = 27; Index number = 54; Length = 6

From MControl number 27 the following data is read:

“M*Start* insertion cycles [n]” and “Extended status”

Explanation of default DP-V1 data:

Table 27 Explanation of default DP-V1 data			
Index 0	Byte 0 – Byte 3	4-Byte Float	Current Phase L1 [A]
	Byte 4 – Byte 7	4-Byte Float	Current Phase L2 [A]
	Byte 8 – Byte 11	4-Byte Float	Current Phase L3 [A]
	Byte 12 – Byte 15	4-Byte Float	Voltage Phase L1 – L3 [V]
	Byte 16 – Byte 19	4-Byte Float	Active Power [kW]
	Byte 20 – Byte 23	4-Byte Float	Contact Temperature Phase L1 [°C]
	Byte 24 – Byte 27	4-Byte Float	Contact Temperature Phase L2 [°C]
	Byte 28 – Byte 31	4-Byte Float	Contact Temperature Phase L3 [°C]
	Byte 32 – Byte 35	ULONG	Operating Hours [h]
	Byte 36 – Byte 39	ULONG	Switching Cycles Contactor K1 [n]
	Byte 40 – Byte 43	ULONG	Switching Cycles Contactor K2 [n]
	Byte 44 – Byte 47	ULONG	Switching Cycles Contactor K3 [n]
	Byte 48 – Byte 49	UWORD	Thermal image [%]
	Byte 50 – Byte 51	UWORD	Time to Reset [sec]
	Byte 52 – Byte 53	UWORD	Time to Trip [sec]
Index 54	Byte 0 – Byte 3	ULONG	M*Start* insertion cycles [n]
	Byte 4 – Byte 7	ULONG	Extended Status (refer to table 25)
	for future use		
	for future use		
	for future use		

Extended Status V1 - Control Access

Table 24 CA Control Access Status

Byte / Bit	CA Status		Remark
Byte 58 - Bit 0	1	HW -Local	M*Control* accepts control commands from the hardwired inputs on M*Control*, when the respective Local control input is set to true.
Byte 58 - Bit 1	1	SW-Local	M*Control* accepts control commands from the hardwired inputs. This control access authority must be given by a command from either the DCS or MView. Note: Does not require the hardwired local input to be set to true.
Byte 58 - Bit 2	1	BUS-Local	M*Control* accepts control commands from a device on the switchgear control network, eg. M*View*.
Byte 58 - Bit 3		Reserved	
Byte 58 - Bit 4		Reserved	
Byte 58 - Bit 5		Reserved	
Byte 58 - Bit 6		Reserved	
Byte 58 - Bit 7	1	Remote	M*Control* accepts control commands from DCS only

Extended status V1 – Common Data

Table 25 Explanation of the 32 bit of extended status for common data

Byte / Bit	Common data	Remarks
Byte 58	CAOwner	Control Access Owner List Refer to Table 25
Byte 59 – Bit 0	Test Activated	Main switch in Test position
Byte 59 – Bit 1	Main Switch On	Main switch in On position
Byte 59 – Bit 2	reserved	
Byte 59 – Bit 3	reserved	
Byte 59– Bit 4	reserved	
Byte 59 – Bit 5	M*Control* Inhibited	Start Inhibit / TOL Inhibit active
Byte 59 – Bit 6	TOL Start Inhibit	TOL Inhibit protection active
Byte 59 – Bit 7	TOL Bypass	TOL Bypass Active
Byte 60 – Bit 0	Common Alarm	Any Common Alarm active
Byte 60 – Bit 1	Common Trip New	Any new Common Trip Active
Byte 60 – Bit 2	Common Trip Acknowledged	Last Common Trip Acknowledged
Byte 60 – Bit 3	Common Trip Reset-able	Present Common Trip Reset-able
Byte 60 – Bit 4	Failsafe	M*Control* in failsafe mode
Byte 60 – Bit 5	reserved	
Byte 60 – Bit 6	reserved	
Byte 60 – Bit 7	reserved	

Extended status V1 – Common Data

Table 26 Explanation of the 32 bit of extended status Motor specific data

Byte / Bit	NR-DOL	REV-DOL	Transparent	Remarks
Byte 61 – Bit 0	Stopped	Stopped		Motor Stopped
Byte 61 – Bit 1	Runs	Runs		Motor Runs
Byte 61 – Bit 2	Runs CW	Runs CW	K1	Motor Runs Clockwise or K1 energized for Transparent
Byte 61 – Bit 3		Runs CCW	K2	Motor Runs Counter Clockwise or K2 energized for Transparent
Byte 61 – Bit 4			K3	K 3 energized
Byte 61 – Bit 5				-
Byte 61 – Bit 6				-
Byte 61 – Bit 7	Ready	Ready		Motor is ready to start
	NR-DOL-Softstart	**NR-Star / Delta**	**Actuator**	**Remarks**
Byte 61 – Bit 0	Stopped	Stopped	Stopped	Motor Stopped
Byte 61 – Bit 1	Runs	Runs	Runs	Motor Runs
Byte 61 – Bit 2			Close	Motor Runs in Closing Direction
Byte 61 – Bit 3			Open	Motor Runs in Opening Direction
Byte 61 – Bit 4				-
Byte 61 – Bit 5	Soft Stop		Close Position	Soft Stop or Close Position
Byte 61 – Bit 6	Soft Start	Star	Open Position	Soft Start or Runs Star or Open Position
Byte 61 – Bit 7	Ready	Ready	Ready	Motor is ready to start

(continued)

Table 26 Explanation of the 32 bit of extended status Motor specific data (continued)

	CFeed	**MFeed**		Remarks
Byte 61 – Bit 0	Off	Off		Contactor / Isolator open
Byte 61 – Bit 1	On	On		Contactor / Isolator closed
Byte 61 – Bit 2				-
Byte 61 – Bit 3				-
Byte 61 – Bit 4				-
Byte 61 – Bit 5				-
Byte 61 – Bit 6				-
Byte 61 – Bit 7	Ready	Ready		CFeed / MFeed ready

Troubleshooting

LED - Status Information

For further details on LED indication please refer to the MNS iS M*Link* Interface Manual.

Hardware ID numbers	**1TGE1020x9Rxxxx**	**1TGE120021R0110**
MLink Types		
Hardware available for MNS iS Versions	up to V6.0	from V6.1 onwards
MNS iS Interface Manual **MLink**	1TGC 91012x M020x	1TGC 91021x M020x

Comms Check

If it is not possible to achieve communications between the Profibus master and the M*Link* , in the first instance please check the following:

Cable connection, shielding, and termination are all in line with the requirements detailed in the following the reference documents [1]; [4] and [5] Profibus additional guidelines section

Slave address settings are correctly parameterized in MNavigate and the parameters have been downloaded to the M*Link* Ensure correct settings and no double addressing in the PROFIBUS network

Master configuration in the DCS, please check the correct GSD file is being utilized, and the correct node is being addressed.

To exclude cable / installation problems use a recommended PROFIBUS cable test device to verify correct installation and wiring. More information on these subjects is available from ABB.

Contact us

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