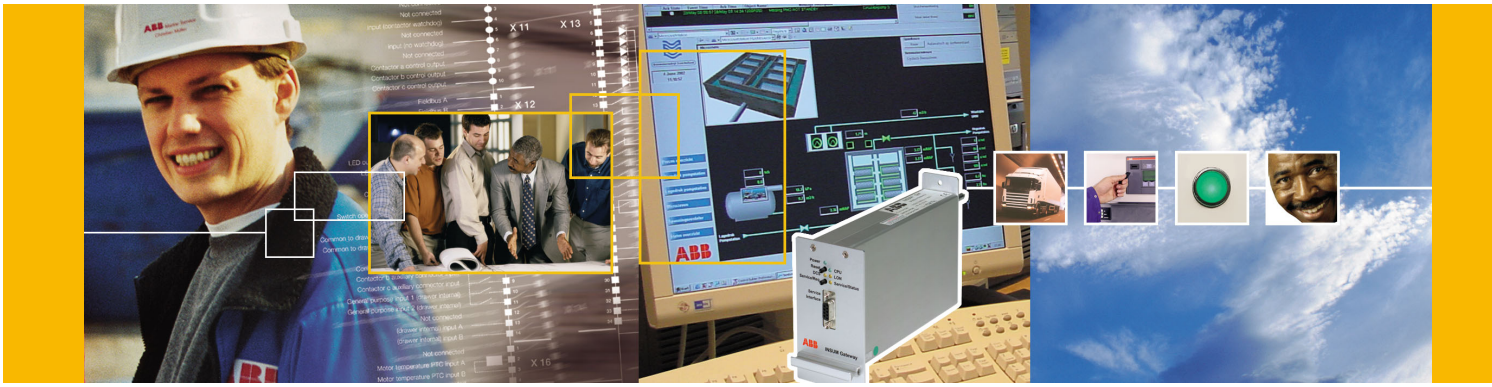
Protect^{IT} – MNS Motor Management INSUM®

PROFIBUS-DP Gateway Manual
Version 2.3



INSUM®
PROFIBUS-DP Gateway Manual

Version 2.3

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Reference document 1TGB 350006 R1.1

PROFIBUS-DP Gateway Manual

Version 2.3

Notes:

1 General Information

1.1 Introduction

This manual describes the PROFIBUS DP Gateway communication interface implemented in INSUM®system according to standard EN 50170. The PROFIBUS DP interface in INSUM System provides interface possibilities to the Process Control Systems or any other external systems that supports PROFIBUS.
The PROFIBUS DP is a Master-Slave protocol wherein the Gateway is always a PROFIBUS slave in all configurations. The master station controls the traffic on the bus, in this case, by PCS or PLC system. The PCS system cyclically reads the input information from the INSUM PROFIBUS Gateway and cyclically writes the output information to the Gateway. Being a standard PROFIBUS DP slave the Gateway supports 49 bytes of input information and 244 bytes of output information.

1.2 Objective

This manual provides detailed information on implementation of PROFIBUS DP interface in INSUM Gateway. It is primarily intended to give slave configuration information to the PCS application programmer and to provide help during installation and commissioning of the PCS-INSUM PROFIBUS DP interface.
The knowledge of PROFIBUS-DP and PCS programming is an added advantage to the reader of this manual.

1.3 Related Documentation and Literature

Please refer to the following documents for more specific details.

Documentation:
1TGC 901007 B0201 INSUM Technical Information
1TGC 901021 M0201 INSUM MCU Users Guide
1TGC 901026 M0201 INSUM MCU Parameter Description
1TGC 901034 M0201 INSUM MMI Operating Instruction
1TGC 901030 M0201 INSUM MMI Quick Guide
1TGC 901042 M0201 INSUM Modbus Gateway Manual
1TGC 901060 M0201 INSUM Ethernet Gateway Manual
1TGC 901080 M0201 INSUM System Clock Manual
1TGC 901090 M0201 INSUM Control Access Guide
1TGC 901091 M0201 INSUM Failsafe Guide
1TGC 901092 M0201 INSUM Dual Redundancy Guide
1TGC 901093 M0201 INSUM Network Management Guide
SACE RH 0080 Rev.I PR112/ PD-L LON Works Interface V2.0
1SEP 407948 P0001 Users Manual Intelligent Tier Switch (ITS)

Literature:
Manfred Popp: PROFIBUS-DP/DPV1, Hüthig Verlag Heidelberg, Germany, 2000

1.4 LON Acronyms and Definitions

The user of this manual should have understanding on the following LON terminology. Further terms and abbreviations used are explained in Annex B.

LON
Local Operating Network. LON is used as shortening for LON Network.

LonTalk protocol
Communication protocol used in LON networks.

LON network
A communication network built using LON technology, including e.g. Neuron chip and LonTalk protocol.

Network variable (NV)
A data item in LonTalk application protocol containing max. 31 bytes of data. The selector is used as network wide identification of the Network Variable. The selector is a 14-bit number in the range 0…12287 (2FFFhex).

SNVT
Standard Network Variable Type. The definition of a SNVT includes unit, range, resolution and data format. SNVTs are listed in the SNVT Master List and Programmer's Guide. This list is updated by Echelon and it includes network variable types, which are commonly agreed to be used by multiple manufacturers.

Monitoring device
A device in system, which collects information from the other devices to be further transferred to another system or to be presented to the user. The devices also provide controlling interface for the system. In INSUM system Gateways, MMI, and INSUM OS are termed as Monitoring devices.

Notes:

Interoperability
Interoperability means that devices can be integrated into a single system without requiring custom node or tool development. Interoperability can also be defined as being the ability of two or more devices or systems to interact with another and exchange data according to a predefined method in order to achieve predictable results.

LonMark
LonMark interoperability association is an independent world-wide industry association, which facilitates the development and implementation of open, interoperable LonWork based control products and systems. LonMark association includes manufacturers, end-users, and integrators of LON products. The association establishes guidelines such as “LonMark Application Layer Interoperability Guidelines."

LonMark object
A set of one or more network variable inputs and/or outputs implemented as SNVTs with semantic definitions relating the behaviour of the object to the network variable values, in addition to a set of configuration properties (parameters).

1.5 Product Highlights
The Gateway provides 24 bits of binary information and one analogue current information to the PCS.
The Gateway communicates to the master station at a communication speed of 1.5MB/s.
One Gateway supports communication to 48 Field Units. The INSUM Communication Unit (ICU) supports 2 Gateways i.e. 96 Field Units per ICU in total.

1.6 Restrictions (Fixed Information Structure)
The information provided from Gateway is not configurable. The Gateway information is predefined.

1.7 Product Overview
The INSUM PROFIBUS Gateway gives access to the PCS/PLC/SCADA System to INSUM Field Unit's i.e. INSUM MCUs, Circuit Breakers and Intelligent Tier Switches. The FUs accept the control commands from the external control system via the Gateway and update continuously the status information and measuring values.
The information available to the control system from different FUs is as listed below.

1.7.1 Status Information

Field Unit	Info available for DCS
MCU (Motor Control Unit)	Motor Running Direction 1 Motor Running Direction 2 Motor Stopped Motor Tripped Motor Warning Main Switch off Test Position Local Control
PR 112	CB open CB closed CB isolated CB springs discharged Harmonic distortion Local Operation Warning Trip
ITS	Fuse blown (Phase 1, 2, 3) Alarm Trip

Notes:

1.7.2 Alarms, Other Information

Field Unit	Info available for DCS
MCU (Motor Control Unit)	Failsafe Lifesign Maintenance Warning including – Operating Hours Maintenance – Switch Cycles Maintenance Cca, Ccb, Ccc General Purpose Input1 General Purpose Input2 Limit switch 1 (Open) Limit switch 2 (Close) Star, Delta N1, N2 Thermal Overload Warning
PR 112	Lifesign Unbalanced phases Contact wear pre-alarm Contact wear alarm Protection L pre-alarm Protection L alarm Protection S alarm Protection G alarm Protection T alarm
ITS	Lifesign Overtemperature Switch connected Overcurrent (phase 1, 2, 3)

1.7.3 Alarms With Trip

Field Unit	Info available for DCS
MCU (Motor Control Unit)	TOL Reset Level Reached Start inhibit alarm Emergency Stop Stalled Trip No Load Trip Torque Trip Phase Current Loss Trip Thermal Overload Trip
PR 112	LC1 opened LC2 opened Protection L Protection S Protection I Protection G Protection T
ITS	Not applicable

Notes:

1.7.4 Measuring Values

Field Unit	Info available for DCS
MCU (Motor Control Unit)	Phase Current L1 (%)
PR 112	Phase Current L1 (%)
ITS	Phase Current L1 (%)

1.7.5 Switching Commands

Field Unit	Info available for DCS
MCU (Motor Control Unit)	Start commands: Start, Start CW, Start CCW, Start CW N2, Start CCW N2 Stop Reset General Purpose Output1 General Purpose Output2
PR 112	CB open CB close CB reset Trip reset LC1 opening block reset LC2 opening block reset LC2 autoreclosure reset
ITS	Not applicable

Notes:

2 Hardware Installation

2.1 Mechanical Setup

The mechanical setup of the Gateway is plug-in type like any other component mounted on the INSUM backplane. The Gateway draws power from the INSUM backplane.

Figure 2-1 PROFIBUS Gateway Module Front

Figure 2-2 PROFIBUS Gateway Rear Plate

2.2 Indication and Control elements

Indication	Function
Power	A green LED indicates that the 24VDC-power supply for the module is available
CPU	A flashing green LED indicates that the Gateway CPU is functioning properly
DCS	A yellow LED indicates that the Gateway communication to DCS is running
LON	A flashing yellow LED indicates that the Gateway is communicating on the main LON bus
Service/Status	A yellow LED indicates the Service/Status of the NEURON (LON Communication Chip) Gateway

Pushbutton	Function
Reset	Executes a hardware reset of the Gateway
Service/Req.	The service button will cause the Gateway to broadcast a service pin message on the network.

2.3 Interfaces

Firmware Download Interface
A 9-pin SUB-D female connector is provided for communication to RS232 interface of PC. The new system software (firmware) can be downloaded via this port using Windows terminal program (16 Bit version) Physical connection RS232C; Baudrate 19.2 fixed. Recognition using bridge in download cable.

Communication Interface
The supported communication media is a shielded twisted pair cable.
The connector for the PROFIBUS interface is located on the backplane front and carried out as 9-pin SUB-D female connector for RS485.

Notes:

2.4 Bus termination

General
Termination of bus at both end is a must to minimise cable reflections and noise level. The DIP switches 1, 2 and 5 should be in 'ON' position in order to terminate the bus at the INSUM PROFIBUS Gateway end. External passive bus terminators (Resistors built in a D-SUB plug connector) are neither supported by the backplane nor by Gateways.
Stub lengths have to be minimized. The sum of all stubs should not exceed 3 meters.

Dip switch arrangement for Bus Termination/ Biasing of PROFIBUS

Switch	Description	Factory Set Position (Default)
1	Biasing of DATA+	Off
2	Biasing of DATA-	Off
3	Biasing of RTS+	Off
4	Biasing of RTS-	Off
5	Termination of DATA	Off
6	Termination of RTS	Off

Termination of PROFIBUS in different configurations:

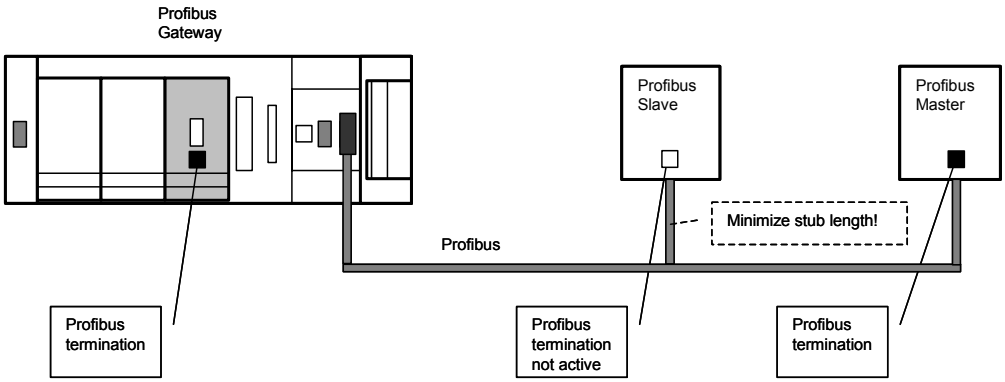

Figure 2-3: Termination of PROFIBUS using one Gateway

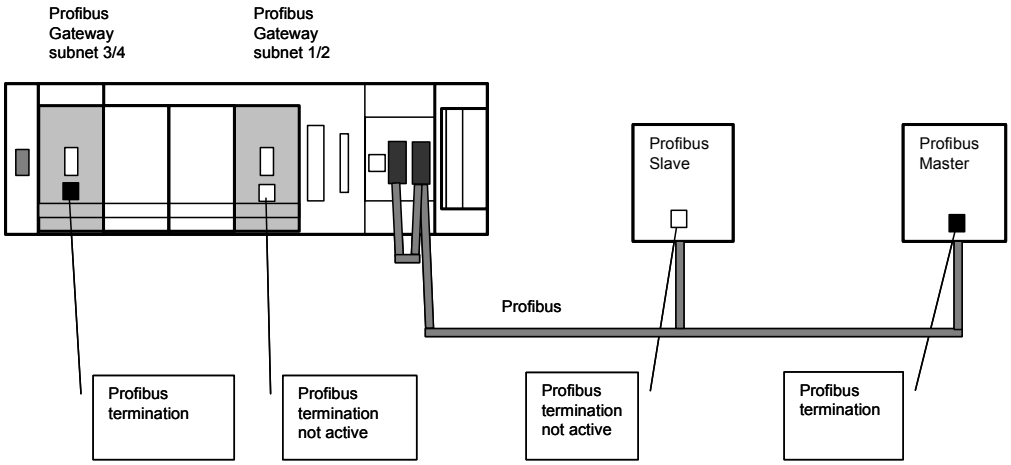

Figure 2-4: Termination of PROFIBUS using two Gateways (1)

Notes:

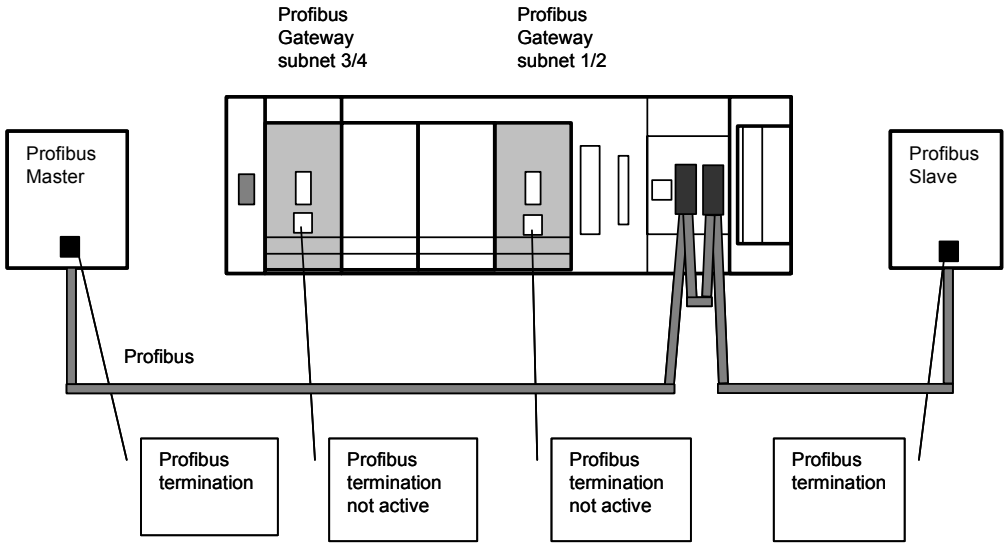

Figure 2-5: Termination of PROFIBUS using two Gateways (2)

Notes:

3 Configuration

The configuration task can be classified into three main activities:

- Configuration of the LON network address and LON network variables using the MMI.
- Configuration of Gateway parameters like PROFIBUS address and used subnet using the MMI.
- Configuration of PCS using Gateways GSD-File (see chapter 4 Interface to PCS)

3.1 Configuration of the LON network address and variables using the MMI

The INSUM components on the LON network communicate to each other using LON network address and network variables. The process of defining the connections among NVs of Insum is called LON Network Binding. The setting of network address and binding is done with the help of MMI in the following way:

1. Select MMIs menu item: SYSTEM INSTALLATION
2. Choose address 5/16 (first PROFIBUS Gateway, see following table)
3. Press the INSTALL button on MMI
4. Press Service button on Gateway
5. Press MMIs DEFAULT button

PROFIBUS Gateway supports 48 field devices. The following table shows possible numbers and LON addresses of MCUs the Gateway is able to work with:

Field device type	Field device LON address	PROFIBUS Gateway LON address	Subnet (Line) Filter	Number of field devices
MCU / ITS	1/1 ... 1/24	5/16	1/2	24
	2/1 ... 2/24			+ 24 = 48
MCU / ITS	3/1 ... 3/24	5/17	3/4	24
	4/1 ... 4/24			+ 24 = 48
PR 112	4/1 ... 4/24	5/17	4	24

3.2 Gateway Parameters

Gateway specific parameters can be configured with the help of the MMI when the Gateway is installed in the LON network (see 3.1).

1. Select MMI menu item: SYSTEM CONFIGURATION
2. Choose PROFIBUS GW to be configured (address 5/16 or 5/17)
3. Select SYSTEM, DEVICE DATA or PROFIBUS
4. Go through the appearing parameters list and select correct parameters
   (Detailed parameter information available hereunder.)

3.2.1 PROFIBUS (Gateway Configuration Data)

INSUM uses the MASTER-SLAVE philosophy. The PROFIBUS Gateway works in slave configuration. The Master is always a Process Control System or other Superior System controlling the process. The data configured is used in the communication to the Master system.

Important: The Gateway is to be re-booted using the Reset Push Button after a change of the parameters “PROFIBUS address” and “Subnet lines”. Otherwise the Gateway will not work with new settings.

- **PROFIBUS (Slave) Address**

This defines the address for the INSUM system when communicating with the DCS.
Address range is 1…126.

- **Subnet Lines**

The PROFIBUS Gateway in INSUM system supports the handling of 48 field devices. One INSUM backplane can handle two PROFIBUS Gateways. The Gateway thus needs to be configured acc. to the subnet lines it is controlling. E.g. Gateway no. 1 is handling field devices on subnet 1 and 2 where as Gateway no. 2 handles field devices on subnet 3 and 4.

- **Hold Data at Reset**

Not available

Notes:

3.2.2 System

In most applications the default values of the device are sufficient to start with. However, they should be tuned as per the application requirement for the optimum usage.

- **Field Device Timeout:**

The MCU sends the cyclic update of MCU binary signals to the backbone devices. The update from MCU must be received within the time specified in this parameter.

- **Control Command Timeout Function**

This parameter enables the repetition of control commands when the acknowledgement is not received from the MCU within a specified time. The control commands are not repeated if the acknowledgement is received within the specified time.

Control Command Timeout:
The device waits till the expiry of the time in this parameter before repeating the control command to the MCU.

- **Failsafe Function**

In decentralized systems like INSUM the motor protection devices are interfaced with serial busses. If this bus fails it is important for the process that the motors are driven into a safe state. Failures in the bus connections may be caused by short circuit, open links or defects in the bus interface of the device. The safe state for a motor depends on the needs of the process and may be different for each motor. Safe states for motors are defined as follows:
– Stop of a running drive
– Start of a drive according to drive type
– Remain in actual state (NOP)
The analysis of the INSUM system structure shows two different situations / locations for a damaged link:
The connection to the external PCS system (PROFIBUS) – section 1
The connection between Backbone and Field Unit (fully or partly) – section 2
Accordingly possible faults are managed by different devices in the system. Faults in section 1 are managed by the Gateway and faults in section 2 are managed by the Field Unit (MCU) itself.

- **Failsafe Heartbeat**

The GW sends cyclically nvoFailsafe according to "Failsafe heartbeat" to all MCU's (subnet 1/2 or 3/4) as broadcast. When MCU receives first time nvoFailsafe it activates the supervision of this heartbeat. In case nvoFailsafe is not received by MCU after "Failsafe timeout" expires MCU goes to parameterized "Failsafe Mode".
nvoFailsafe-heartbeat can be interrupted due to broken communication link between GW and MCU
Failsafe supervision in MCU is not active when set to LOCAL.

Failsafe Heartbeat Parameter:
This parameter activates and defines the time interval at which the failsafe heartbeat is broadcasted to the MCUs.

Counsel:
The Failsafe Timeout time on MCU's must be defined with respect to this parameter. Also, note that if the Failsafe Heartbeat is enabled on two or more Gateways (dual redundant configurations), the MCU will activate the failsafe mode only when the Failsafe Heartbeat is not received within the failsafe timeout from any of the devices.

- **Failsafe Timeout PLC**

The communication on the PROFIBUS is supervised using a timeout-mechanism, i.e. a fault situation is recognised when the PLC OK bit is not set on PROFIBUS interface by PLC for a certain time. This timeout value can be configured (GW parameter "Failsafe timeout PLC"). In such a fault situation Gateway stops sending of nvoFailsafe as heartbeat. When the communication from PLC to GW is established again the GW starts sending nvoFailsafe as heartbeat again.

Failsafe Timeout PLC Parameter:
The Gateway waits until the expiry of this time before it stopps sending of failsafe signal. . If the MCU does not receive this signal within parameterized Failsafe Timeout, MCU activates the Failsafe Mode. If the communication with the PLC system is resumed during this time, Gateway will not stop sending of Failsafe signal.

- **SU Lifesign Heartbeat:**

This parameter determines the time interval at which the SU Lifesign Heartbeat is to be sent by the backplane device. The other stations monitor the receipt of this signal for a defined time interval. If other stations during the specified time do not receive this signal, the device will be taken out from the SU Lifelist of the other stations.

Notes:

- **SU Lifesign Timeout:**

This parameter defines the time for the receipt of the SU Lifesign signal from the other backbone devices. The backbone device waits till this time before taking out the other backbone devices from it's SU Lifelist.

- **SU Lifelist Heartbeat Function**

The backbone devices GW, MMI and INSUM OS supervise each other and keep the check on their availability. Each station sends a special signal 'SU Lifesign' to indicate that they are 'alive'.

- **SU Lifelist Heartbeat:**

This parameter defines the time interval at which the SU lifelist is to be sent to the MCU's. The 'Station Lifelist Timeout' Parameter on the MCU monitors the receipt of SU lifelist.

- **Control Access Priority:**

This parameter assigns the priority order to the backbone device in CA mechanism. The CA mechanism works in a hierarchical manner. The hierarchy is maintained as per the priority assigned to the device. The Control Access is then handled based on the priority order. Up to 16 stations can be defined for the priority order. The station defined with a CA priority 1 has the highest priority and the station with CA priority 16 is the lowest one. The CA priority should be assigned unique to every device.

- **Control Access Name:**

The name assigned in this parameter is used in the MCU CAT. The name thus represents the device in the CAT.

3.2.3 Device Data

The Device Data show the current versions of backplane devices like MMI, Gateway, and INSUM OS. The information is directly read from the devices and is for user information only.

Important: A new Gateway from factory uses default parameters. Those should not be changed if not necessary.

- **Firmware Version:**

The data in this field shows firmware version of the device with it's date of release. With this, the user can confirm the version existing on the device. This can also be used as a check while upgrading the software. The field will show the upgraded software version if the upgrade is successful.
This field is specific to MMI and Gateway.

- **Hardware Version:**

The data in this field shows hardware version of the device. With this, the user can confirm the version existing on the device. This can also be used as a compatibility check of hardware while upgrading the device to new software release.

- **Parameter File Version:**

The data in this field shows parameter file version of the device. With this, the user can confirm the correctness of a parameter file used.

Notes:

4 Interface to PCS

4.1 INSUM PROFIBUS DP Protocol

PROFIBUS distinguishes between Master and slave devices. Master devices determine the data communication on the bus. A master, also called active stations in the PROFIBUS protocol, can send messages without an external request when it holds the bus access rights i.e. token. Slave devices, also referred as passive devices do not have bus access rights and they can only acknowledge received messages or send messages to the master as and when requested.

The INSUM PROFIBUS Gateway is a PROFIBUS slave device that responds when a query from the Master station i.e. PCS is being received.

The PROFIBUS Gateway address is configured via the MMI (see chapter 3.2.1). The DCS must be configured for communication with INSUM using this particular address.

4.2 GSD-File

The information on how to configure the INSUM PROFIBUS Gateway as PROFIBUS slave in PCS system is described in the Gateway GSD data file as specified by PROFIBUS standard. The *.GSD file is a text file containing description of the PROFIBUS device, with a predetermined syntax. The content of the INSUM PROFIBUS Gateway is important for the configuration of PROFIBUS slave device in PCS system.

GSD-Data for INSUM Gateway PROFIBUS-DP
(available in electronic format on request)

```
;=====================================================
; GSD File for INSUM Gateway PROFIBUS-DP
; ABB Schaltanlagentechnik GmbH
; Date : 27.09.02
;=====================================================
#PROFIBUS_DP
```

General parameters

```
Vendor_Name          = "ABB Schaltenlagentechnik GmbH"
Model_Name           = "INSUM Gateway PROFIBUS-DP 23"
Revision             = "V2.3"
Ident_Number         = 0x067E
Protocol_Ident       = 0
Station_Type         = 0
FMS_supp             = 0
Hardware_Release     = "1.0"
Software_Release     = "2.3"
9.6_supp             = 0
19.2_supp            = 0
93.75_supp           = 0
187.5_supp           = 0
500_supp             = 0
1.5M_supp            = 1
3M_supp              = 0
6M_supp              = 0
12M_supp             = 0
MaxTsdr_9.6          = 60
MaxTsdr_19.2         = 60
MaxTsdr_93.75        = 60
MaxTsdr_187.5        = 60
MaxTsdr_500          = 100
MaxTsdr_1.5M         = 150
MaxTsdr_3M           = 250
MaxTsdr_6M           = 450
MaxTsdr_12M          = 800
Redundancy           = 0
Repeater_Ctrl_Sig    = 0
24V_Pins             = 0
…
```

Notes:

Slave-Specification:
Freeze_Mode_supp = 0
Sync_Mode_supp = 0
Set_Slave_Add_Supp = 0
User_Prm_Data_Len = 0
Auto_Baud_supp = 0
Min_Slave_Intervall = 30
Modular_Station = 0

Module Definition List
Module= "Insum Gateway 48xFD+LocalSW"
0x40,0x3F,0x40,0x3F,0x40,0x3F,0x40,0x2F,0x40,0x03,0x80,0x00,0x80,0x2F,0x80,0x05
EndModule

4.3 General data structure inside PROFIBUS Gateway

Gateway recognizes automatically device type of field devices. CB's will only accepted if they are located in subnet 4.

4.3.1 Read status bits and measurement values

Read using service Data_exchange, NIL-SAP (Value active when bit set.)

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Description
0	**Status bits and measurement value of device 1 (MCU, ITS or PR112)**								Field device 1
1									
2									
3									
4									
5	**Status bits and measurement value of device 2 (MCU, ITS or PR112)**								Field device 2
6									
7									
8									
9									
	Data of further devices (2...48, byte 5...239)								
240	Device with CA Priority 8	Device with CA Priority 7	Device with CA Priority 6	Device with CA Priority 5	Device with CA Priority 4	Device with CA Priority 3	Device with CA Priority 2	Not used	Lifelist Backbone
241	Not used	Not used	Not used	Device with CA Priority 13	Device with CA Priority 12	Device with CA Priority 11	Device with CA Priority 10	Device with CA Priority 9	Lifelist Backbone
242									Not used
243									Not used

Notes:

4.3.2 Write commands

Write using service Data_exchange, NIL-SAP
* Commands are valid only when DCS_OK bit (byte 0, bit 0) is set. Bit starts failsafe supervision of PROFIBUS if related parameter (Failsafe Timeout PLC) enabled.
** Bit change from 0->1 sets field device mode from Bus to Local-Software, Change 1->0 sets field device mode from Local-Software to Bus. Command will be sent only if DCS OK is set. Local software is a function of MCU and not supported by CB PR112 or ITS.

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Description
0								PLC OK =1*	Start Failsafe Function, Enable switching command
1	**Switching command of device 1 (MCU, CB, empty in case of ITS)**								Device 1
2	**Switching command of device 2 (MCU, CB, empty in case of ITS)**								Device 2
3	**Switching command of device 3 (MCU, CB, empty in case of ITS)**								Device 3
	Switching commands of further devices (Device 4...48, byte 4...48)								
49	Local-SW** FD 8 (1/8 or 3/8)	Local-SW** FD 7 (1/7 or 3/7)	Local-SW** FD 6 (1/6 or 3/6)	Local-SW** FD 5 (1/5 or 3/5)	Local-SW** FD 4 (1/4 or 3/4)	Local-SW** FD 3 (1/3 or 3/3)	Local-SW** FD 2 (1/2 or 3/2)	Local-SW** FD 1 (1/1 or 3/1)	For MCUs only
50	Local-SW** FD 16 (1/16 or 3/16)	Local-SW** FD 15 (1/15 or 3/15)	Local-SW** FD 14 (1/14 or 3/14)	Local-SW** FD 13 (1/13 or 3/13)	Local-SW** FD 12 (1/12 or 3/12)	Local-SW** FD 11 (1/11 or 3/11)	Local-SW** FD 10 (1/10 or 3/10)	Local-SW** FD 9 (1/9 or 3/9)	
51	Local-SW** FD 24 (1/24 or 3/24)	Local-SW** FD 23 (1/23 or 3/23)	Local-SW** FD 22 (1/22 or 3/22)	Local-SW** FD 21 (1/21 or 3/21)	Local-SW** FD 20 (1/20 or 3/20)	Local-SW** FD 19 (1/19 or 3/19)	Local-SW** FD 18 (1/18 or 3/18)	Local-SW** FD 17 (1/17 or 3/17)	
52	Local-SW** FD 32 (2/8 or 4/8)	Local-SW** FD 31 (2/7 or 4/7)	Local-SW** FD 30 (2/6 or 4/6)	Local-SW** FD 29 (2/5 or 4/5)	Local-SW** FD 28 (2/4 or 4/4)	Local-SW** FD 27 (2/3 or 4/3)	Local-SW** FD 26 (2/2 or 4/2)	Local-SW** FD 25 (2/1 or 4/1)	
53	Local-SW** FD 40 (2/16 or 4/16)	Local-SW** FD 39 (2/15 or 4/15)	Local-SW** FD 38 (2/14 or 4/14)	Local-SW** FD 37 (2/13 or 4/13)	Local-SW** FD 36 (2/12 or 4/12)	Local-SW** FD 35 (2/11 or 4/11)	Local-SW** FD 34 (2/10 or 4/10)	Local-SW** FD 33 (2/9 or 4/9)	
54	Local-SW** FD 48 (2/24 or 4/24)	Local-SW** FD 47 (2/23 or 4/23)	Local-SW** FD 46 (2/22 or 4/22)	Local-SW** FD 45 (2/21 or 4/21)	Local-SW** FD 44 (2/20 or 4/20)	Local-SW** FD 43 (2/19 or 4/19)	Local-SW** FD 42 (2/18 or 4/18)	Local-SW** FD 41 (2/17 or 4/17)	

Notes:

4.3.4 Examples of 16-Bit measurement value (MSB, LSB) for current L1

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Decimal value
3 (MSB)	0	0	0	0	0	0	0	0	
4 (LSB)	0	0	0	0	0	0	0	1	= 1
3	0	0	0	0	0	0	0	0	
4	0	0	0	1	0	0	0	0	= 16
3	0	0	0	0	0	0	0	0	
4	1	1	1	1	1	1	1	1	= 255
3	0	0	0	0	0	0	0	1	
4	0	0	0	0	0	0	0	0	= 256
3	0	0	0	0	0	0	0	1	
4	0	0	0	0	0	0	1	0	= 258
3	0	0	0	0	0	0	1	0	
4	0	0	0	0	0	0	0	0	= 512

Notes:

4.4 Detailed data structure of INSUM field devices

4.4.1 Data structure of MCU

Status bits and measuring values

Description	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Motor Status	N	Local control 1=local 0=bus	Test	Main Switch off (earlier Drawer Off_Pos)	Common Warning	Common Trip	Stop	Run-CCW	Run or Run-CW
Motor	N+1	TOL Warning	N2 (MCU2 only) or Delta (MCU2 only) or limit2=Close (MCU2 only)	N1 (MCU2 only) or Star (MCU2 only) or limit1=Open (MCU2 only)	General Purpose In 2 *(MCU2 only)*	General Purpose In 1 *(MCU2 only)*	Maintenance Warning	Lifesign	Failsafe
Motor Trips	N+2	TOL Trip	Phase Current Loss Trip	Torque Open or Torque Close Trip *(MCU2 only)*	No Load Trip	Stalled Trip	EM Stop Trip	Start inhibit alarm (earlier TOL Inhibit Level reached)	TOL Reset Level Reached
Meas. Values	N+3	Phase 1 Current [%]- Most Significant Byte(MSB)							
	N+4	Phase 1 Current [%]- Least Significant Byte (LSB)							
And so on for other 47 motors (Byte 5..239)									
Lifelist SU (ICU)	240	Device with CA Priority 8	Device with CA Priority 7	Device with CA Priority 6	Device with CA Priority 5	Device with CA Priority 4	Device with CA Priority 3	Device with CA Priority 2	Not used
Lifelist SU (ICU)	241	Not used	Device with CA Priority 15	Device with CA Priority 14	Device with CA Priority 13	Device with CA Priority 12	Device with CA Priority 11	Device with CA Priority 10	Device with CA Priority 9
NA	242								
NA	243								

If no other description, bit = 1 means information, warning, trip is active. (E.g. Lifesign = 1 –> MCU is alive)

Notes:

Write output information

Description	Byte	Bit7	Bit6	Bit5	Bit4	Bit5	Bit2	Bit1	Bit0
PROFIBUS communi-cation	0								DCS OK =1
Motor_1 Command	1	Start-CCW-N2 *(MCU2 only)***	Start-N2 *(MCU2 only)* or Start-CW-N2 *(MCU2 only)***	General Purpose Out 1 *(MCU2 only)****	General Purpose Out 2 *(MCU2 only)****	Reset Trip**	Stop**	Start-CCW or Start-CCW-N1 *(MCU2 only)* or Close *(MCU2 only)***	Start or Start-CW or Start-CW-N1 *(MCU2 only)* or Open *(MCU2 only)***
And so on for other 47 motors (Byte 2..48)									
Local SW Command	1 out of Bytes 49…54	Local Soft Command (1 Bit per MCU, for details see chapter 4.3.2)							

Note:
** Motor Command (bit 0... 3, 6, 7). One of these six bits should be set to 1. All other combinations are invalid and will not executed. Only in case of a change in these six bit's switching command will be sent to the MCU. Motor related commands are executed only if DCS_OK bit (byte 0, bit 0) is set. DCS_OK bit starts PROFIBUS failsafe mechanism if related parameter enabled.
*** Requires MCU parameter settings: GpOut Open: 1, GpOut Closed: 0.

Valid MCU bit combinations:

Bit 7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Command sent to field device
0	0	X	X	0	0	0	1	Start or Start-CW or Start-CW-N1 (MCU2 only) or Open (MCU2 only)
0	0	X	X	0	0	1	0	Start CCW or Start CCW-N1 (MCU2 only) or Close (MCU2 only)
0	0	X	X	0	1	0	0	Stop
0	0	X	X	1	0	0	0	Reset Trip
0	1	X	X	0	0	0	0	Start-N2 (MCU2 only) or Start-CW-N2 (MCU2 only)
1	0	X	X	0	0	0	0	Start-CCW-N2 (MCU2 only)

Notes:

4.4.2 Data structure of PR 112 - Programmable CB Release

Status bits and measurement values:

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Description
N	Any warning	Any trip	CB isolated	CB open	CB closed	CB springs discharged	Local operating mode	Harmonic Distortion	
N+1	Unbalanced phases	Protection L pre-alarm	Protection L alarm	Protection S alarm	Protection G alarm	Protection T alarm	Lifesign	Contact pre-wear alarm	
N+2	Protection L trip	Protection S trip	Protection I trip	Protection G trip	Protection T trip	LC1 has opened	LC2 has opened	Contact wear alarm	
N+3	L1 current [%]		MSB (Most Significant Byte)						Phase current
N+4	L1 current [%]		LSB (Last Significant Byte)						Phase current

Value active when bit set.

Switching commands:

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Description
M	Not used	CB reset**	CB close**	CB open**	LC2 auto reclosure reset**	LC2 opening block reset**	LC1 opening block reset**	Trip reset**	

Note:
** At the same time it's not allowed to set more than one bit (Bit 0, 1, 2, 3, 4, 5, 6) to 1. Bit combinations with more than one bit set are not valid and will not performed.
Gateway sends only a switch command to CB when Gateway recognizes a change in bit 0, 1, 2, 3, 4, 5, 6. Commands are executed only if DCS_OK bit (byte 0, bit 0) is set.

Valid PR 112 bit combinations:

Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Command sent to field device
0	0	0	0	0	0	1	Trip reset (Lon-Code: 0)
0	0	0	0	0	1	0	LC1 opening block reset (Lon-Code: 1)
0	0	0	0	1	0	0	LC2 opening block block reset (Lon-Code: 2)
0	0	0	1	0	0	0	LC2 auto reclosure reset (Lon-Code: 3)
0	0	1	0	0	0	0	CB open (Lon-Code: 4)
0	1	0	0	0	0	0	CB close (Lon-Code: 5)
1	0	0	0	0	0	0	CB reset (Lon-Code: 6)

Notes:

4.4.3 Data structure of ITS - Intelligent Tier Switch

Status bits and measurement value:

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Description
N				Any Alarm	Any Trip	Fuse Phase 3 blown	Fuse Phase 2 blown	Fuse Phase 1 blown	
N+1	Over-temp.		Over-current Phase 3	Over-current Phase 2	Over-current Phase 1	Switch connected	Lifesign		
N+2									
N+3	L1 current [%] MSB (Most Significant Byte)								Phase current
N+4	L1 current [%] LSB (Last Significant Byte)								Phase current

Value active when bit set.

Switching command:

Byte	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0	Description
M	Not used/ empty	Not used/ empty	Not used/ empty	Not used/ empty	Not used/ empty	Not used/ empty	Not used/ empty	Not used/ empty	

Notes:

5 Additional functions

In addition to the main function, PROFIBUS Gateway performs a variety of additional functions, which are described in the following chapters.

5.1 Firmware-Download

The Firmware containing the whole application software code of the units is stored in a non-volatile Flash-EPROM. A new firmware version can be loaded via service port.

Download via the Serial Link

Using terminal.exe PC program, the new firmware can be loaded from a connected PC via the serial link through the service interface.

5.2 Failsafe

Supervision of field bus

The communication on the field bus is supervised by the MCU using a timeout-mechanism. The Gateway sends cyclically a message (nvoFailsafe) to the MCU. The fault situation is defined, as a MCU has not received a message from Gateway for a certain time (GW Parameter: Failsafe Heartbeat, MCU parameter: Failsafe Timeout). In a fault situation the MCU goes into configured state. In case parameter "Failsafe timeout PLC" is not activated supervision of field bus starts immediately.

Please note: Failsafe mechanism is not available for PR 112 and ITS.

Supervision of the PROFIBUS and fieldbus

The communication on the PROFIBUS is supervised by the Gateway using a timeout-mechanism , i.e. a fault situation is recognized when byte 0, bit 0 of PROFIBUS Write Output Table is not set cyclic by PCS to 1. This timeout value (Failsafe timeout PLC) can be configured. The Gateway responds the fault situation by sending of a message (nvoFailsafe= activated) via the LON-network to each field device. Afterwards the field device goes into configured state. After this PCS or PROFIBUS failure bus supervision starts by setting of bit 0 again.

5.3 Life List for ICU Stations

To supervise the availability of the Gateways and the MMIs for other units on the LON network these stations cyclically send a heartbeat message on the network. Every ICU station receives this message and generates a Life List, which is cyclically updated. One ICU station propagates this list to all field devices (except ITS). Life List appears in PROFIBUS Read Input Table too.
The position of every ICU station in the Life List is configurable by CA Priority. The cycle time (SU Lifesign Heartbeat), the timeout (SU Lifesign Timeout) and heartbeat (SU Lifelist Heartbeat) are configurable.

Notes:

6 Annex A - Technical Data

6.1 Mechanical Data

Enclosure	Aluminium Metal Case
Dimensions	135 x 67 x 215 mm (HxWxD)
Weight	ca. 0,75 kg

6.2 General Electrical Data

Power Supply	24 V DC (18...36 V DC)
Power Consumption (max.)	5,0 W
Nominal Current (typ.)	175 mA
Inrush Current	< 350 mA
Storage Temperature	-20 °C to +80 °C
Operating Temperature	-5 °C to +70 °C
Protection Class	IP 30
MTBF	15 years

6.3 Electromagnetic Compatibility (EMC)

Standard *	Subject		Level	Class	Criteria
EN 50081-1	0.15 – 0.5 MHz	(230VAC *)	79/66 dBuV	B	-
	0.5 – 30 MHz	(230VAC *)	73/60 dBuV	B	-
EN 50081-1	30 – 230 MHz (Case)		30 dBuV	B	-
	230 – 1000 MHz	(Case)	37 dBuV	B	-
EN 61000-4-2	Contact discharge		6 kV	3	A
EN 61000-4-3	Sinus modulation		10 V/m	3	A
EN 61000-4-4	230 VAC *		4 kV	4	A
	24 VDC power supply lines		2 kV	3	A
	Lon XP 1250		2 kV	4	A
	PROFIBUS RS485		2 kV	4	A
EN 61000-4-5	230 VAC * asymetrical / symetrical		2/1 kV	3	A
	24 VDC power supply lines asymetrical / symetrical		1 kV	2	A
	LON XP 1250		2 kV	3	A
	PROFIBUS RS485		2 kV	3	A
EN 61000-4-6	230 VAC *		10 V	3	A
	24 VDC		10 V	3	A
	Lon XP 1250		10 V	3	A
	PROFIBUS RS485		10 V	3	A
EN 61000-4-11	230 VAC *	70 % Un	10 ms	A	-
		40 % Un	1000 ms	A	-
		<5 % Un	5000 ms	C	-
PR EN 61000-4-29	Voltage dips 24 VDC	70 % Un	1000 ms	A	-
	Voltage dips 24 VDC	40 % Un	100 ms	A	-
	Voltage dips 24 VDC	<5 % Un	30 ms	A	-

* with power supply unit 1TGB302006

Notes:

6.4 Insulation test

Standard	Subject	Reference Point	Level	Class
IEC 60255-5 chap.4	24 V DC	Ground plane	+/- 0.8 kV	3
	24 V DC	Internal bus lines	+/- 0.8 kV	3
	Bus lines	Ground plane	+/- 0.8 kV	3

6.5 Environmental Testing

Subject	International Standard	European Standard
Vibration (sinusodial)	IEC 255-21-1	
Shock and bump	IEC 255-21-2	
Cold	IEC 68-2-1	EN 60068-2-1
Dry heat	IEC 68-2-2	EN 60068-2-2
Vibration (sinusodial)	IEC 68-2-6	EN 60068-2-6
Damp heat, cyclic	IEC 68-2-30	EN 60068-2-30

Notes:

7 Annex B - INSUM Terms and Abbreviations

Abbreviation	Term	Explanation / Comments
	Alarm	Alarm is defined as status transition from any state to abnormal state. Status transition to abnormal state can be data crossing over the predefined alarm limit.
	Backplane	INSUM backbone, holds following INSUM devices: Router, Gateways, Clock, Power Supply. Part of the INSUM Communication Unit, see ICU
CA	Control Access	A function of INSUM system that allows definition of operating privileges for each device level (e.g. PCS, Gateway, field device)
CAT	Control Access Table	Table containing control access privileges
CB	Circuit Breaker	Circuit breaker unit (here: ABB SACE Emax with electronic release PR112-PD/LON)
CT	Current Transformer	Current Transformer
DCS	Distributed Control System	see also PCS
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 LON fieldbus (e.g. motor control units or circuit breaker protection)
FU	Field Unit	see Field Device
GPI	General Purpose Input	Digital input on MCU for general use
GPO	General Purpose Output	Digital output on MCU for general use
GPS	Global Positioning System	System to detect local position, universal time and time zone, GPS technology provides accurate time to a system
GW	Gateway	A Gateway is used as an interface between LON protocol in INSUM and other communication protocols (e.g. TCP/IP, PROFIBUS, Modbus)
HMI	Human Machine Interface	Generic expression for switchgear level communication interfaces to field devices, either switchboard mounted or hand held
ICU	INSUM Communications Unit	INSUM Communications Unit consists of devices such as backplane, Gateways, Routers, System Clock and power supply. It provides the communication interface within INSUM and between INSUM and control systems. Formerly used expressions: SGC, SU
INSUM	INSUM	Integrated System for User optimized Motor Management. The concept of INSUM is to provide a platform for integration of smart components, apparatus and software tools for engineering and operation of the motor control switchgea
INSUM OS	INSUM Operator Station	Tool to parameterise, monitor and control devices in the INSUM system
ITS	Integrated Tier Switch	The Intelligent Tier Switch is an ABB SlimLine switch fuse with integrated sensors and microprocessor based electronics for measurement and surveillance
LON	Local Operating Network	LON is used as an abbreviation for LonWorks network. A variation of LON is used as a switchgear bus in the INSUM system
LonTalk	LonTalk protocol	Fieldbus communication protocol used in LonWorks networks

Notes:

Abbreviation	Term	Explanation / Comments
LonWorks	LonWorks network	A communication network built using LonWorks network technology, including e.g. Neuron chip and LonTalk protocol
MCU	Motor Control Unit	Motor Control Unit is a common name for a product range of electronic motor controller devices (field device) in INSUM. A MCU is located in a MNS motor starter, where its main tasks are protection, control and monitoring of motor and the related motor starter equipment.
MMI	Man Machine Interface	The switchgear level INSUM HMI device to parameterize and control communication and field devices.
MNS	MNS	ABB Modular Low Voltage Switchgear
	Modbus, Modbus RTU	Fieldbus communication protocol
NV,nv	LON Network Variable	Network variable is a data item in LonTalk protocol application containing max. 31 bytes of data.
Nvi, nvi	LON Network Variable input	LON bus input variable
Nvo, nvo	LON Network Variable output	LON bus output variable
OS	Operator Station	see INSUM OS
PCS	Process Control System	High level process control system
PLC	Programmable Local Controller	Low level control unit
PR	Programmable Release	Circuit breaker protection/release unit (here: ABB SACE Emax PR112-PD/LON)
	PROFIBUS DP	Fieldbus communication protocol with cyclic data transfer
	PROFIBUS DP-V1	Fieldbus communication protocol, extension of PROFIBUS-DP allowing acyclic data transfer and multi master.
PTB	Physikalisch-Technische Bundesanstalt	Authorized body in Germany to approve Ex-e applications.
PTC	Positive Temperature Coefficient	A temperature sensitive resistor used to detect high motor temperature and to trip the motor if an alarm level is reached.
RCU	Remote Control Unit	Locally installed control device for motor starter, interacting directly with starter passing MCU for local operations.
	Router	Connection device in the LON network to interconnect different LON subnets. Part of the INSUM Communications Unit.
RTC	Real Time Clock	Part of the INSUM System Clock and and optionally time master of the INSUM system
SCADA	Supervisory Control and Data Acquisition	
SGC	Switchgear Controller	Former term used for INSUM Communications Unit
SU	Switchgear Unit	Former term used for INSUM Communications Unit
	System Clock	INSUM device providing time synchronisation between a time master and all MCUs. Part of the INSUM Communication Unit, see ICU
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.
TFLC	Thermal Full Load Current	See MCU Parameter Description for explanation
TOL	Thermal Overload	See MCU Parameter Description for explanation
	Trip	A consequence of an alarm activated or an external trip command from another device to stop the motor or trip

Notes:

Abbreviation	Term	Explanation / Comments
		the circuit breaker.
UTC	Coordinated Universal Time	Coordinated Universal Time is the international time standard, formerly 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 hours clock.
VU	Voltage Unit	Voltage measurement and power supply unit for MCU 2
	Wink	The Wink function enables identifcation of a device on the LON network. When a device receives a Wink-message via the fieldbus, it responds with a visual indication (flashing LED)

Notes:

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