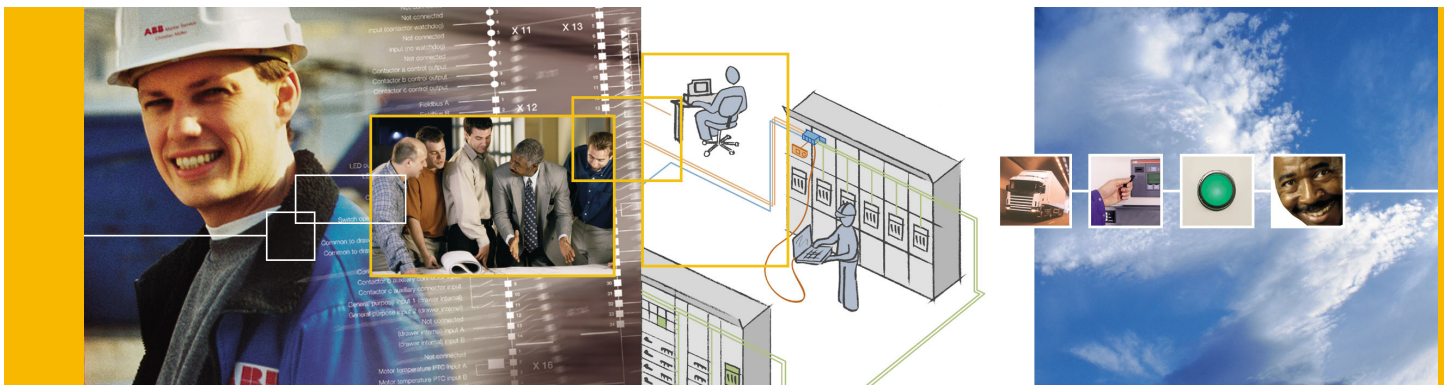


Protect^{IT} – MNS Motor Management INSUM[®]

Failsafe Guide Version 2.3





INSUM[®]
Failsafe Guide

Version 2.3

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Failsafe Guide

Notes:

1 General

1.1 Objective

This document describes the Failsafe function within the INSUM system.

1.2 Related Software Version

The Failsafe function as described is implemented in INSUM 2.3.

1.3 Related 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 901052 M0201 INSUM Profibus Gateway Manual
1TGC 901060 M0201 INSUM Ethernet Gateway Manual
1TGC 901080 M0201 INSUM System Clock Manual
1TGC 901090 M0201 INSUM Control Access 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)

Notes:

2 Overview

2.1 Purpose of Failsafe

In decentralized systems as INSUM 2 the motor protection devices are interfaced with serial busses. If this bus connection fails, it is important for the process, that the motors are driven into a safe state. Failure in the bus connections are caused by short circuit, open links or defects in the bus interface of the device.

The safe state for a motor depends from the needs of the process and may be different for each motor.

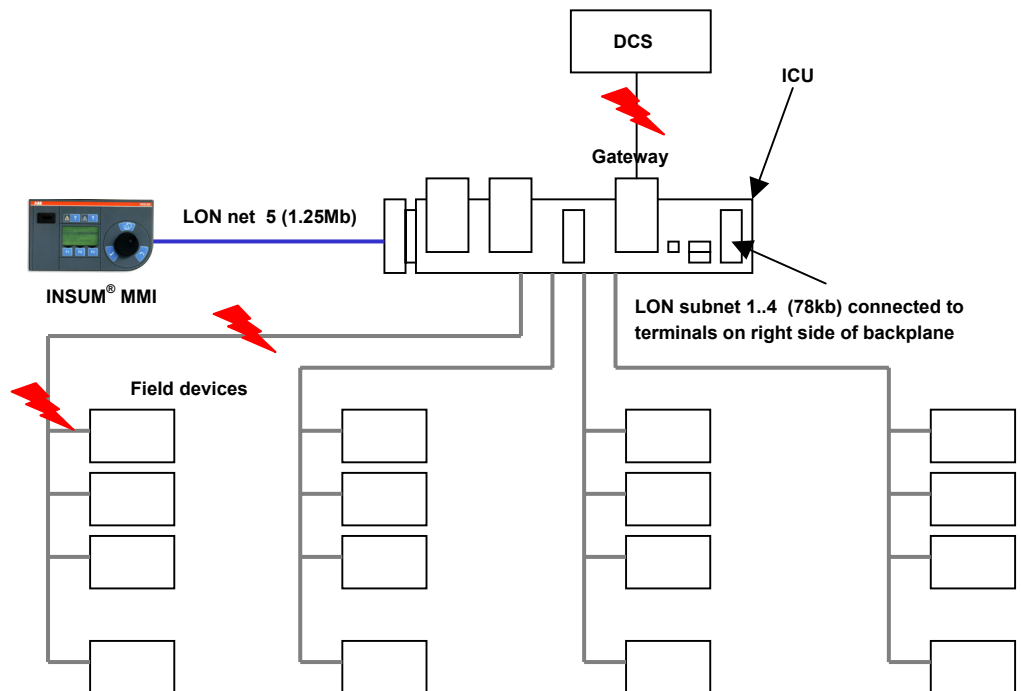
2.2 Definition of safe states of a motor

Safe states for motors are defined as follows:

1. Stop of a running drive (STOP)
2. Start of a drive cw (START CW)
3. Start of a drive ccw (START CCW)
4. Remain in actual state (NOP)

2.3 Possible failures in connections

Figure. 1. INSUM System configuration with locations of possible failures



Failsafe function depends on the system structure and configuration. In an INSUM standard configuration (see fig.1) with non redundant connections to control systems three different situations / locations for a connection failure may apply:

1. the connection from Gateway to the external DCS system
2. the connection between ICU and more than one motor controller (all or particular MCUs connected to one and the same Router)
3. the connection between ICU and one motor controller

Faults are managed by different devices in the system:

- Faults in section 1 are managed by the interface to the DCS (Gateway installed at the ICU). This is done by supervision of the data traffic on the link to the DCS.
- Faults in section 2 and 3 are managed by the controller itself (MCU). This is done by supervision of the LON bus connection between MCU and Router.

Find further information in the example described in the following chapter.

Notes:

3 Functional Description

Note: The failsafe function has to be activated by setting a respective GW failsafe heartbeat. Please consider chapter 3.3 "Parameterizing example".

3.1 Supervision of LON-Bus

Gateway sends cyclically nvoFailsafe network variable according to parameter "Failsafe heartbeat" to all MCU's as broadcast. When MCU receives first time nvoFailsafe it activates the supervision of this heartbeat. In case nvoFailsafe is not received by MCU after parameterized timeout "Failsafe timeout" MCU goes to parameterized "Failsafe Status".

Note:

Failsafe supervision in MCU is not active when set to LOCAL or after power-on-reset.

NvoFailsafe-heartbeat can be interrupted due to broken communication link between GW and MCU (e.g. broken cable, broken Router etc.)

3.2 Supervision of DCS connection

MODBUS Gateway, PROFIBUS Gateway

The Gateway is monitoring the link to the DCS and checks the cyclic telegrams received from the DCS.

The first time a Gateway receives requests from a PLC it activates the supervision according to parameter "Failsafe timeout PLC". The failsafe message nvoFailsafe is sent to MCUs as long as the connection is correct and new data telegrams are received from the DCS.

When the timeout "Failsafe timeout PLC" expires and no further requests are received the GW stops sending nvoFailsafe as heartbeat. MCU goes to parameterized "Failsafe Status" after timeout.

When the communication from PLC to Gateway is re-established the Gateway starts again with sending of nvoFailsafe as heartbeat.

Ethernet Gateway

The Gateway supervises the client (DCS) connection.

During establishing of a TCP/IP connection the client specifies the timeout interval "LifeCheckTime" and sets the value "TriggerFailsafe". Supervision is activated. The failsafe message nvoFailsafe is sent to the MCUs as heartbeat as long as the connection is correct.

If timeout "LifeCheckTime" expires in one of the TCP/IP connections, the Gateway reacts depending on the setting of parameter "FailsafeMethod":

- a) "Active": Sends network variable nvoFailsafe to MCUs with data content "Activate failsafe mode". MCUs go immediately to parametrized Failsafe Status after receiving this command. Afterwards the sending of nvoFailsafe is stopped.
- b) "Passive": Stops sending nvoFailsafe as heartbeat. In this case MCUs go to parameterized Failsafe Status after timeout.

After re-establishment of the TCP/IP connection or in case other connections are still alive (value TriggerFailsafe is set) sending of nvo Failsafe as heartbeat starts again.

For more detailed information, see INSUM Ethernet Gateway Manual.

Notes:

3.3 Parametering example (MODBUS/ PROFIBUS Gateway)

The GW heartbeat and timeout parameter has to be set to make sure that link failures are detected correctly.

See following parametering example:

Gateway parameters:

System – Failsafe heartbeat: 1 s
System – Failsafe timeout PLC: 9 s (in case PLC polls every 3 seconds)

MCU parameters:

System – Failsafe timeout: 5 s
Motor control – Failsafe Status: STOP

Parametering rules to be applied:

MCU-Failsafe timeout $\geq 3 * \text{Gateway-Failsafe heartbeat}$
Gateway-Failsafe timeout PLC $\geq 3 * \text{maximum time between PLC requests}$

Depending on the application the parameters can be different. This has to be verified and tested during the commissioning of the INSUM system.

For details about parameters and parametering refer to the respective manuals for MCU and Gateways.

Notes:

4 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 switchgear
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 2 system

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Abbreviation	Term	Explanation / Comments
LonTalk	LonTalk protocol	Fieldbus communication protocol used in LonWorks networks
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 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

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Notes:

Abbreviation	Term	Explanation / Comments
TOL	Thermal Overload	See MCU Parameter Description for explanation
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.
	Trip	A consequence of an alarm activated or an external trip command from another device to stop the motor or trip the circuit breaker.
VU	Voltage Unit	Voltage measurement and power supply unit for MCU 2
	Wink	The Wink function enables identification 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)



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