System Design and Engineering

AutroSafe Interactive Fire & Gas Detection System (IFG)

116-P-SYSDEENGIN-IFG/XGB, Rev. *A, 2015-08-14*, Autronica Fire And Security AS

CE

Table of Contents

1. Introduction

1.1 About the Handbook

This document provides a description of the AutroSafe Interactive Fire and Gas Detection System (IFG).

It provides a total overview of the system, including:
- a general description of the system architecture
- system units
- requirements
- system functionality
- preinstallation and projecting guidelines
- use of the PowerLoop Calculator Tool
- troubleshooting

Appendix includes typical connection diagrams, reliability and availability of SIL, operation and maintenance, plus information on configuration and software tools.

1.2 The Reader

This handbook is intended for engineers, projecting consultants, sales personnel and technical personnel responsible for the projecting, installation and commissioning of the system.

1.3 Reference Documentation

The table below shows an overview of the *standard* technical marketing documentation for AutroSafe. Reference is made throughout this handbook to topics covered by this documentation (the name of the handbook and part number are explicitely stated where a reference is made).

Document Name	Part number	File name
System Description	116-P-ASAFE-SYSTEMD/EGB	asafesystemd_egb
Installation Handbook	116-P-ASAFE-INSTALL/DGB	asafeinstall_dgb
Commissioning Handbook	116-P-ASAFE-COMMISS/EGB	asafecommiss_egb
Operator's Handbook	116-P-ASAFE-OPERATE/FGB	asafeoperate_fgb
User Guide	116-P-ASAFE-USERGUI/LGB	asafeusergui_lgb
Wall Chart	116-P-ASAFE-WALLCHA/LGB	asafewallcha_lgb
Menu Structure	116-P-ASAFE-MENUSTR/MGB	asafemenustr_mgb
Cable Specifications	116-P-ASIFGCABLESPEC/CGB	asafeifgcable_cgb
Safety Manual	116-BS-1386	-

2. Terms, Abbreviations/Acronyms and Definitions

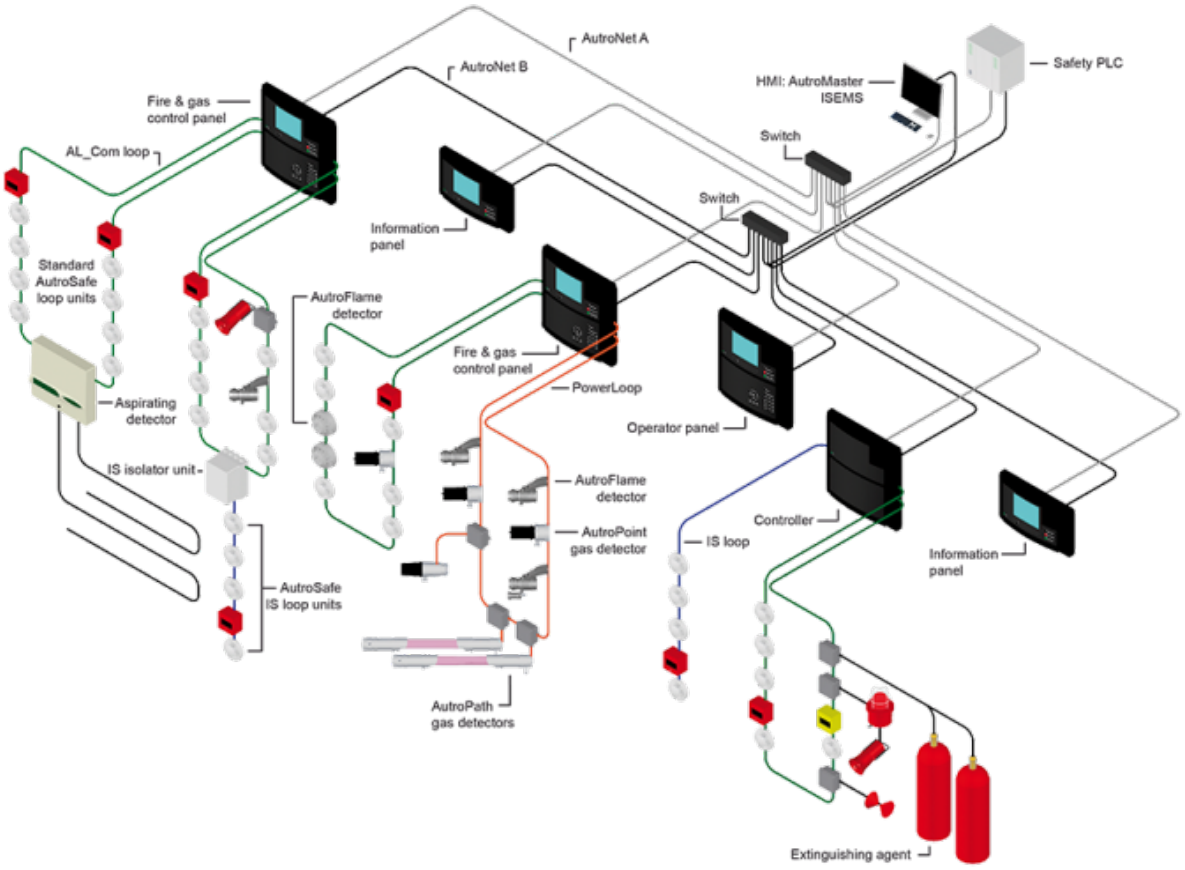
Term	Abbr/ Acron	Definition
AL_Com		The Autronica loop communication protocol for detectors and I/O units.
AutroCom		The Autronica communication protocol between AutroSafe and AutroMaster or other third party systems.
AutroFieldBus	AFB	The Autronica serial interface and low level protocol for field devices (loop controllers and power units / AutroSafe).
AutroMaster ISEMS		The Autronica top-level graphical presentation system. ISEMS: Integrated Safety and Emergency Management System
AutroNet		The system's local area network.
Cause & Effect	C&E	Logic functions performed in the panel.
Dual Safety	DS	An AutroSafe system consisting of a Primary System and a Secondary System. The purpose of the concept is to ensure that the Secondary System takes over the control of the detection loops if the Primary System is lost for any reason.
End of Line	EOL	Typically used for End of Line resistors for monitoring of inputs/outputs.
Fault Warning Routing Equipment	FWRE	Intermediate equipment which routes a fault warning signal from (B) to a fault warning signal receiving station.
Fire Alarm Control Panel	FACP	A Fire (and Gas) control panel for interfacing detection loops and I/O modules.
Human Machine Interface	HMI	Graphical interface for the operator/user.
Integrated Fire and Gas	IFG	Integration of Fire and Gas detectors to the same control panel.
Main Fire Alarm Panel	MFCP	The Main fire alarm control panel used in a configuration, typically the boot panel.
Fire Alarm Device	FAD	Equipment used to give warning of fire, for example, sounder or visual indicator.
Fire Alarm Routing Equipment	FARE	Intermediate equipment which routes an alarm signal from control and indicating equipment to a Fire Alarm Receiving Station.
Fire Protection Equipment	FPE	Fire control or fighting equipment, e.g. extinguishing installation.
I/O	I/O	Input/Output
Loop Unit		A Point, an I/O unit or an Electronic Sounder that is connected to a detection loop.
Manual Call-Point	MCP	A device for the manual initiation of an alarm.
Point		A detector or a manual call point.
PowerLoop		The Autronica loop communication protocol for high power gas and flame detectors. 2-wire loop for both power and communication.
Safety Integrity Level	SIL	Definition of Safety Integrity Level according to IEC 61508.
System Unit		A unit that is directly connected to AutroNet.
Software	SW	Software

3. Brief Introduction

The AutroSafe Self Verify™ Integrated Fire and Gas detection system described in key words is as follows:

- Both the Fire Detectors as well as the Gas Detectors can be connected to the same panel or system.
- All detectors are interactive addressable devices with intelligent communication. Non-addressable detectors can be connected via a 4-20mA interface.
- Field devices have a built-in calibrated self-test to verify and confirm their ability to perform correctly. This can be considered as supplemental to – and can be used instead of – manual testing and inspection routines. Refer to Chapter 4.4.
- Flame and Gas Detectors can be connected to the AutroSafe Panel by using a 2-wire loop structure (PowerLoop). The PowerLoop provides both power to, as well as interactive communication with the detectors. Studies have shown that the Fire & Gas Detection Control System's cable requirement can be reduced with 30-60% by utilizing this concept as opposed to conventional systems.
- AutroSafe SelfVerify™ IFG is a modular and distributed system providing maximum flexibility. The AutroNet communication facilitates the possibility to link cause and effect across panels within the same AutroNet. In other words, any detector connected to any panel can activate any output associated to any panel. Each panel can have up to 12 custom AutroSafe I/O modules. Within the limitations of the system, the system designer can freely select the type and number of modules to be used.
- There are a number of versatile communication options available:
  - Physical: Ethernet, RS-232, RS-422, RS-485, Al_Com loop, AutroFieldBus, PowerLoop and either hardwired or fibre-optic based AutroNet (Ethernet).
  - Protocols: Modbus RTU Slave or Master, Modbus TCP/IP Slave or Master, ESPA 4.4.4. and AutroCom (Autronica's proprietary protocol).

The figure below shows an example of a typical AutroSafe Integrated Fire & Gas system:



- Fully integrated PowerLoop detectors are connected to the two-wire PowerLoop, no additional interfaces are required.
- Any 4-20mA devices can be connected to the system's PowerLoop by means of the BN-342 4-20mA interface. No additional power supply is required, the PowerLoop will supply both the BN-342 module as well as the detector attached to it.
- Advanced Open Path Gas Detectors connected to the BN-342 4-20 mA interface provides the highest level of detection performance. Including, but not limited to false alarm immunity, logging and trending of analogue detector readings.

- The smoke- and heat detectors on the Al_Com loop employ the *DYFI+* technology, a dynamic filtering system which virtually eliminates false alarms and provides the earliest possible warning of a potential fire. A single pair of wires that provides both power to – as well as interactive communication with – the detectors, connects detectors, manual call points and interfaces. The Al_Com loop also features the SelfVerify function, testing the detectors to the calibrated set point every 24hours.

- Automatic addressing of detectors – No switch settings required.

For a detailed general description of the AutroSafe SelfVerify™ Integrated Fire and Gas System, please refer to Chapter 4.4.

4. General Description

4.1 SIL 2 approved AutroSafe SelfVerify™ Integrated Fire & Gas System

Refer to illustration in Chapter 3; a typical topology for the AutroSafe Integrated Fire and Gas system.

Addressable Flame and Gas Detectors, as well as Smoke, Heat and other Fire detectors together with Manual Call Points are all connected to the AutroSafe system that continuously monitors the field equipment for any type of fault. Most of the detectors also support the SelfVerify™ function, which is a calibrated self-test, controlling the functionalities of each detectors.

A maximum of 127 points, being a combination of addressable SelfVerify™ Smoke detectors, Heat detectors, Manual Call Points, Extinguishing Release Buttons and I/O units can be connected to one Al_Com loop of the AutroSafe IFG panel. Each panel has a total capacity of 6 loops/512 points (EN-54/2 limitation). Intrinsically Safe detectors can be connected to the Al_Com loop via galvanic isolators. A maximum of 20 detectors can be connected per isolator.

Up to a maximum of 15 addressable Gas and/or Flame detectors can be connected to each PowerLoop, depending on power load and cable length/specifications. Each AutroSafe IFG panel can support one AutroFieldBus ring, which is capable of handling up to 31 PowerLoop drivers.

Detectors with a 4-20mA signal transferral can be connected to the PowerLoop by means of the BN-342 interface unit.

The AutroSafe IFG system facilitates utilization of the SelfVerify™ functionality. The SelfVerify™ technology allow the system to “look after itself” by performing a calibrated self-test of all SelfVerify™ detectors and panels every 24hours, thus improving system availability, whilst reducing maintenance and testing requirements to a minimum.

By combining connection of Flame and Gas detectors onto the same 2-wire PowerLoop, less cabling will be required for the system installation, thus a significant reduction in installation cost. A proportional cable weight reduction comes as a bonus.

With the SelfVerify™ functionality, high reliability and reduced maintenance requirements, the AutroSafe IFG system offers a highly competitive Life Cycle Cost.

All Smoke detectors, Heat detectors and Manual Call Points are available in safe area, Zone 0, Zone 1 and Zone 2 versions.

4.2 Key Features and Cost Reduction

- All detectors are addressable and include in-built short circuit, open circuit and ground fault monitoring and protection.
- Less cabling. A potential saving of 30-60% on Flame and Gas detection loops cable requirements.
- No need for direct-wired (point-to-point) analogue inputs.
- Reduction in the cabinet space requirement compared to traditional systems.
- Life cycle cost reduced due to the SelfVerify™ technology. The SelfVerify™ functionality is available for all integrated Autronica Fire and Gas detectors. A calibrated self-test, which reduces maintenance requirements and maintenance costs to a minimum is automatically performed every 24 hours.
- Scalable and modular system allows for flexibility. Panels may be added to – or removed from – the AutroSafe network at any time.
- AutroSafe addressable system is the world's first IEC61508 SIL 2 approved system holding TÜV certification. It is the only addressable system in the world that has been fully approved and certified as a complete system according to this standard.
- An IEC61508 SIL 2 compliant communication link is available for providing F&GDCS status to other systems.
- All Autronica Al_Com addressable detectors employ the dynamic filtering system *DYFI* +, which virtually eliminates false alarms and provides the earliest possible warning of a potential fire.
- The smoke detector can be offered in a high sensitivity version that is normally used for "early warning" smoke detection.
- Automatic addressing of detectors – No manual switch setting is required.

4.3 Distributed System Topology

The AutroSafe SelfVerify™ IFG is a distributed system where panels can be situated in local equipment- or instrument rooms close to the detectors. The system is linked together by use of the AutroNet network.

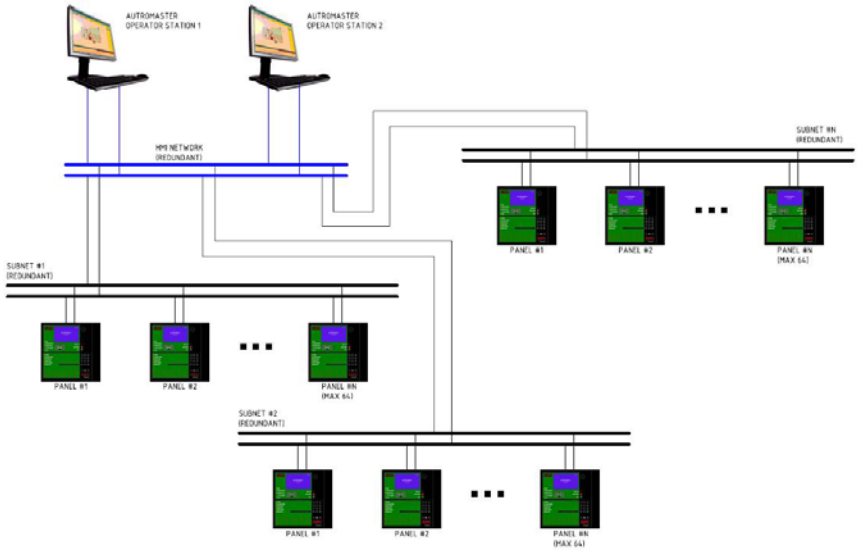
4.3.1 System Architecture

AutroSafe 4 operates on a high-speed and fully redundant Ethernet-based network solution; AutroNet, providing extremely fast data transmission. A maximum of 64 system units (panels, controllers) can connect to the AutroNet. A standalone system is also possible, using the Fire Alarm Control Panel BS-420 (the mandatory panel in any system). The main circuit board in each single panel/cabinet provides two Ethernet ports, enabling redundancy.

The FACP and MFCP will be connected through a dedicated TCP/IP network. Exact topology to be finalized during detailed design. The network has the ability to share a common Cause and Effect (C&E), making us able to carry out logic operations across buildings. The F&G panels are also able to share logic functions across networks by means of plant wide actions performed by a centralized operator station.

All detection and activation, Cause and Effect, can be done locally for each building, i.e. each building can be an independent self-contained system providing SIL 2 requirements where required.

The figure below shows how AutroMaster operator stations are used to monitor the entire F&G network.



Using AutroMaster operator stations to monitor different subnets

One or more AutroSafe Fire and Gas Alarm Panel are located in the designated area as applicable. Detectors, manual call points, sounders/beacons and I/O units are connected to the panel(s).

I/O controlling information is connected via I/O modules inside the panel or I/O units mounted on the field loops.

Example of I/O information:
-HVAC
-Building Electrical Shutdown
-Fire extinguishing release agent

The table below shows the key information for the AutroSafe system.

Maximum number of	Standard System	Dual Safety System	SIL 2 System
System units (panels) per system (connected to the local area network; AutroNet)	64	16 (Pri) 16 (Sec)	32
Loop units per system	15000	5000	7500
Modules per fire alarm control panel / controller	12	18	12
Detection Loops per fire alarm control panel / controller	6	12*	6
Loop units per system unit (panel)	512	1024	512
Loop units per detection loop	127	127	127
Loop units per branch on a detection loop	32	32	32
Loop units per Intrinsically Safe (IS) branch on a detection loop	20	20	20
Loop units per Powerloop	15	15	15
Socket sounder / loop sounders per detection loop	40	40	40
AutroFieldBus units connected to AutroFieldBus	31	31	31
Ethernet ports per fire alarm control panel / controller	2	2	2
USB host ports per fire alarm control panel / controller	2	2	2

* 6 Loops on panel internal I/O stack and 6 loops on BSD-321 I/O stack.

4.3.2 AutroNet

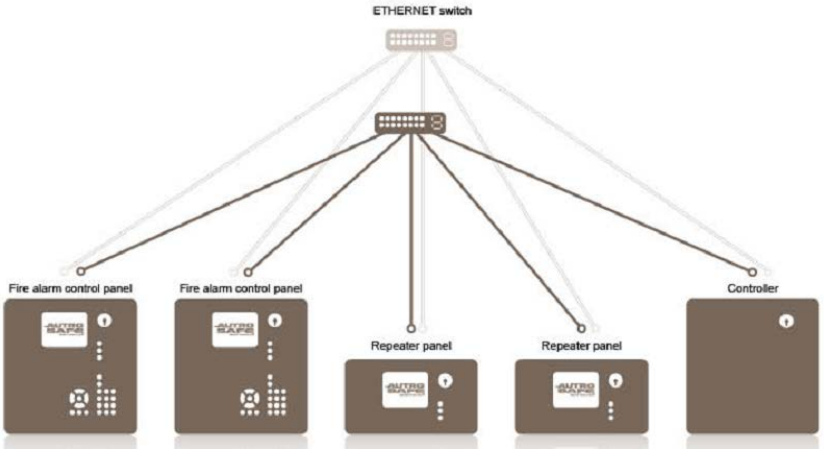
A network solution (AutroNet) with more than two panels requires the use of switches. Only Phoenix Ethernet switches are approved and supported by Autronica Fire and Security AS.

For approved switches refer to System Decription, Phoenix Ethernet Switches.

The switch type and the number of switches depend on the actual installation / network design (number of panels and the distances between the panels/switches).

AutroSafe uses a redundant network and for increased safety switches in the two networks should be powered from different sources.

The figure below shows a typical network system. The transmission length between the panels and an Ethernet switch does not exceed 100 meters.



If the transmission length between two Ethernet switches exceeds 100 meters, a fibre optic cable can be used to achieve longer distances. An Ethernet switch equipped with a multi-mode or single-mode fiber optic port is required.

AutroNet networks are formed between panels for data exchanging throughout the system. This solution provides I/O status availability at any panel connected to the same network. The top-level DCS or HMI communication link can therefore be connected to any panel in an AutroNet, or to any switch in the network directly.

For the maximum number of panels attached to an AutroNet refer to the table in chapter 4.3.1.

4.3.3 AutroFieldBus

AutroFieldBus is used to connect the BSD-321 protocol converter, power supplies and the BSD-340 Powerloop driver module to the AutroSafe Panel. An AutroFieldBus interface communicates with all these devices.

The BSD-321 module provides a way to remotely connect I/O modules to an AutroSafe panel. It also allow for a redundant loop control – Dual Safety – refer to AutroSafe's System Description (116-P-ASAFE-SYSTEMD/EGB) for further description of this concept.

Point Gas Detectors, Flame Detectors and 4-20mA interfaced detectors can be connected to the PowerLoop driver, BSD-340, via a 2-wire loop.

The BSD-340 PowerLoop module and the BSD-321 module can be powered locally. They can be located inside the cabinet or in the field, in close proximity to the detectors – thus further reducing cable requirements. Refer to PowerLoop description in Chapter 4.8.1.

4.4 SelfVerify™

All Autronica detectors that are supplied for use in the AutroSafe Integrated Fire and Gas detection system have got the unique SelfVerify™ test function. This calibrated self-test is performed every 24 hours.

Up to this point, Fire and Gas alarm systems have been depended on careful manual inspections, involving a number of potential problems. For example, the detector may be mounted out of reach. The maintenance personnel may not have access to particular areas etc.

Furthermore, a manual test is not 100% reliable. Test gas/smoke is rarely applied to the detector in the manufacture's recommended amount, and even a faulty detector may eventually give an alarm if its detection chamber is filled with enough test gas/smoke. Leaving detectors inhibited after inspection, adds another safety risk into the manual testing procedures.

AutroSafe SelfVerify™ will solve most maintenance problems. Time-consuming, difficult and costly manual tests are no longer needed. AutroSafe SelfVerify™ not only tests whether a detector is capable of processing an alarm – it even verifies the sensitivity of each individual detector with a calibrated signal. The system ensures that each detector will always respond to the correct alarm level. The alarm initiated by the SelfVerify™ function is routed through the AutroSafe system, testing that the complete system is able to give an alarm. Of course stopping short, prior to actually activating any outputs.

4.5 Response Time

The AutroSafe IFG system's response time for the first alarm entering the system is ≤ 2 seconds, for all type of detectors.

The maximum response time from first alarm entering the system until it is processed and reported via AutroCom is ≤ 2 seconds, refer to table below.

Signal	Hardware	Response time
Alarm	Output module	< 2 sec
Alarm	AutroCom	< 2 sec
Alarm	Panel display	< 1 sec
Analoge value	AutroCom	2 sec (0.5 Hz)

4.6 Configuration/Special Tools

Configuration files for AutroSafe are produced by means of the AutroSafe Configuration Tool. This is a special software package that runs on any modern PC with Windows. Refer to the AutroSafe Configuration Help System integrated into the AutroSafe Configuration Tool for details.

Special tools, which simplify configuration, FAT and commissioning are also available:

- AS-2000 SW – Loop Diagnostics Tool, reads loop topology. Data generated by AS-2000 can be used in the AutroSafe Configuration Tool directly. The tool also provides easy diagnostics, fault finding and testing facilities during commissioning and maintenance. This tool can be used with any Al_Com type of detection loop.
- Loop Simulator SW – Can simulate all detection loops connected to a panel and it provides an efficient way of performing a FAT.

For further details, refer to the handbooks for the special tools.

4.7 Communication to External Systems

4.7.1 Modbus Protocol Communication for C&E Data to Control System

AutroSafe can support single or dual Modbus RTU interfacing communication with Control Systems. AutroSafe can act as both Modbus Slave or Modbus Master and the options for connection are two-wire RS-232 and four wire RS-422 or two-wire RS485 with external converter. Also Modbus TCP/IP can be used and allow for up to six instances for each AutroSafe panel. The Modbus interface provides status information from the Fire & Gas Detection Control System to other control- or presentation systems.

AutroSafe System status is also transferred. Available commands are Silence sounders, Reset, set digital output and set time and date. For further details, refer to the installation and commissioning handbook for the Modbus interface.

4.7.2 AutroSafe AutroCom Protocol

AutroCom is an Autronica proprietary protocol for AutroSafe, which is designed to allow the AutroSafe Panel to communicate with external systems directly. The AutroCom protocol can be transferred on many physical layers, including RS-232, RS-422, RS-485 and Ethernet. The control system supplier must implement this protocol to be able to read it. An AutroCom implementation gives the most extensive functionality in communication performance between AutroSafe and other systems. However, in most projects the Modbus alternative will provide sufficient functionality. Note that the Modbus communication protocol is not SIL 2 certified.

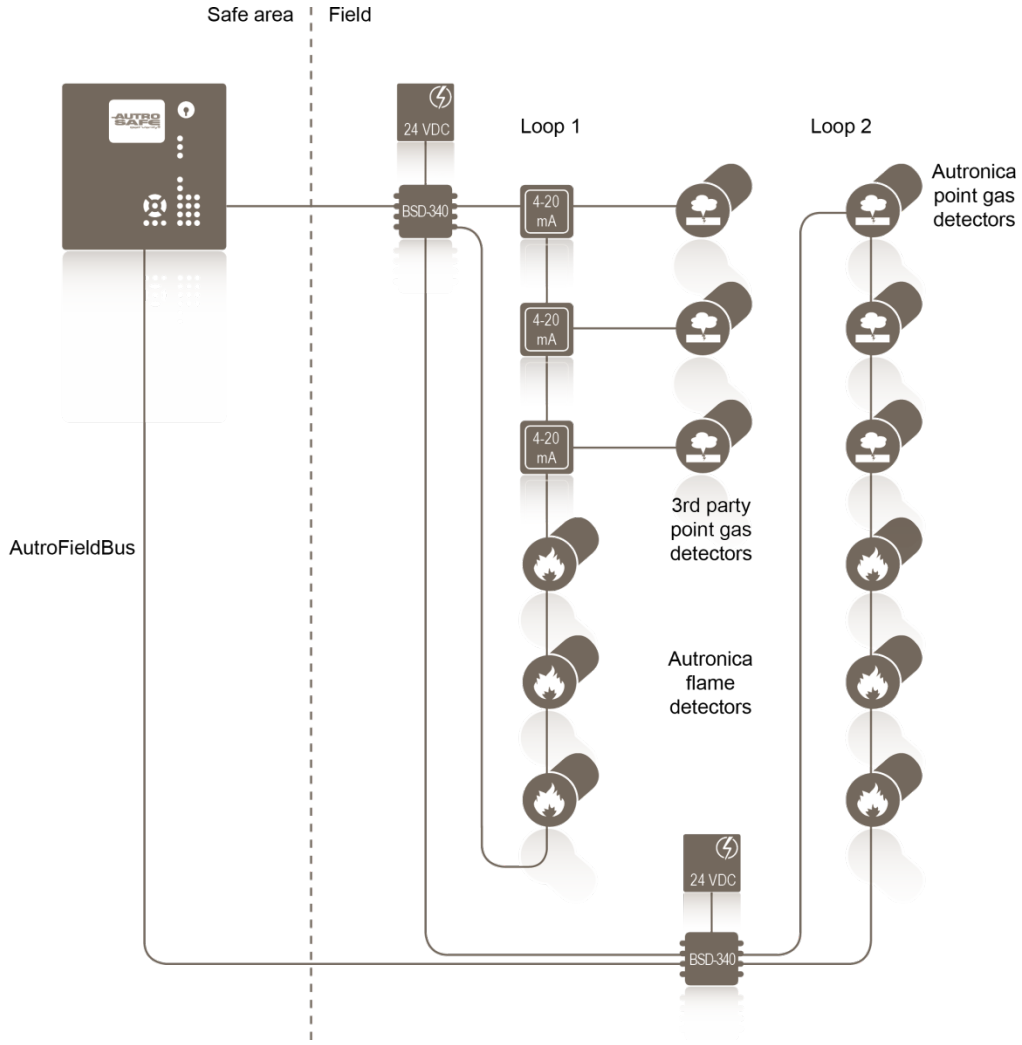
4.7.3 ESPA 4.4.4. Protocol

ESPA 4.4.4 is available by means of a protocol interface. It is mostly used for communication with pager systems, corridor display systems and for mobile phone SMS messaging systems.

4.8 Detection Loops

4.8.1 Power Loop (BSD-340)

PowerLoop is a **two-wire** addressable loop used to interface Flame Detectors and point Gas Detectors to the AutroSafe IFG Panel via the AutroFieldBus. Up to 15 devices may be connected in one addressable loop, depending on the power consumption of the field devices and the cable topology.



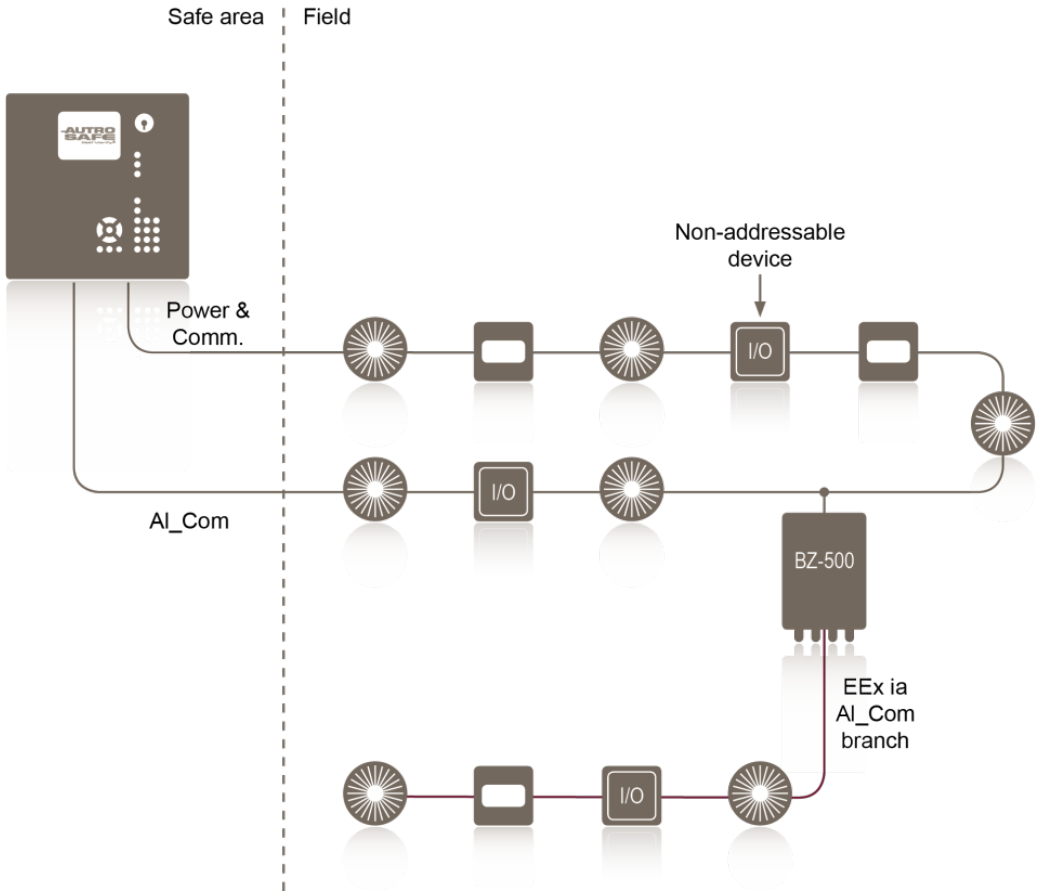
PowerLoop can source a total of 100W (30VDC) to the devices attached to the loop. It is possible to connect up to 15 field devices to one PowerLoop: The number and placement of the detectors connected to each loop has to be calculated during the design phase as this depends on the power consumption of the connected units, loop length and dimensions of the cable.

The diagram shows a selection of direct interfaced detectors and 4-20mA interface units connected to the BSD-340 PowerLoop driver.

A maximum of 31 PowerLoop modules can be connected to one AutroSafe. A combination of BSD-340 and BSD-321 modules can be connected in one AutroFieldBus ring to the AutroSafe panel.

4.8.2 Al_Com Detection Loop (BSD-310/BSD-311)

Smoke and Heat detectors, Manual Call Points, Extinguisher Release Buttons and addressable interface units are connected to either BSD-310 or BSD-311 loop modules. The BSD-311 is a high power Al_Com loop driver that can be used instead of the BSD-310 if the detectors and loop sounders draw more than 140mA from the driver. Loop sounders are not shown in below diagram.



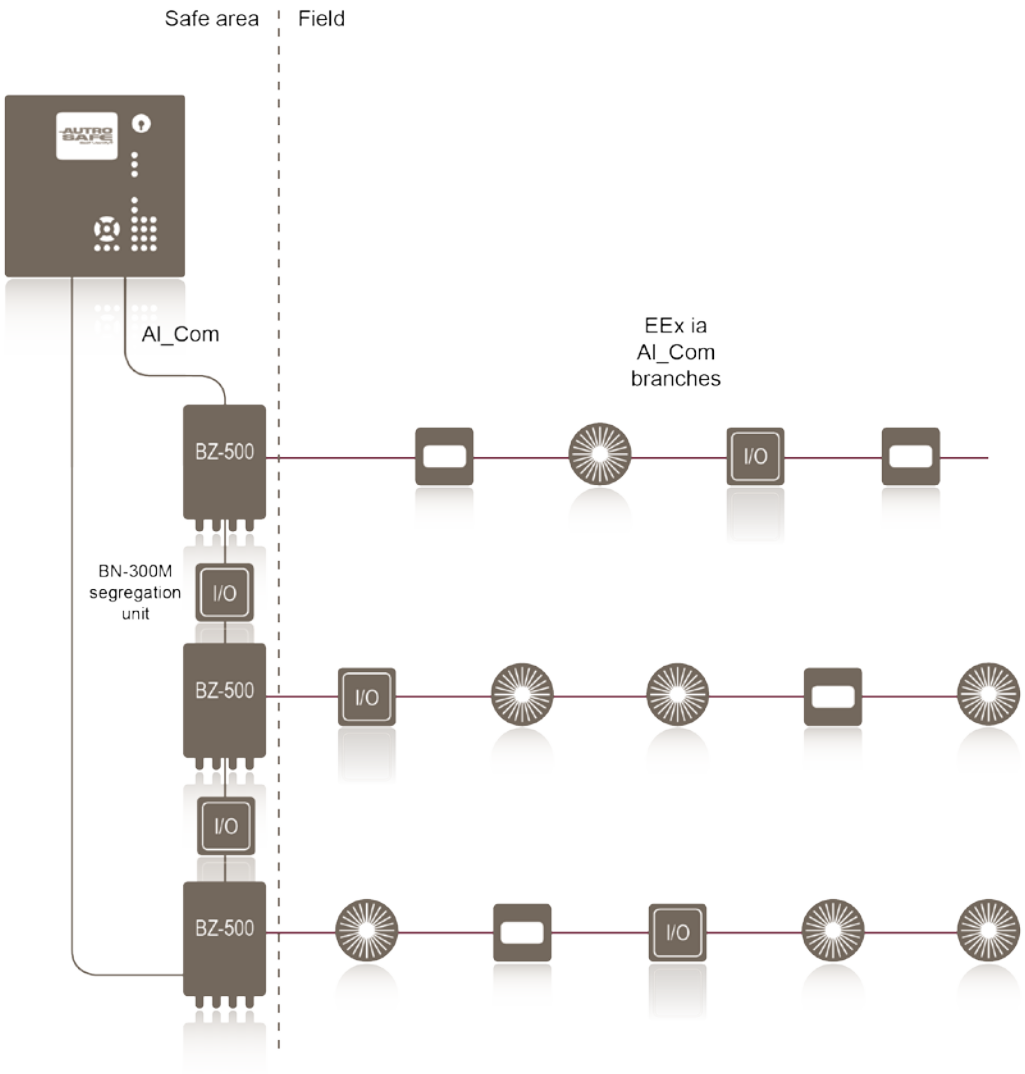
The fully automatic Al_Com loop communication between the detectors and the AutroSafe Panel is interactive. Except for the safety polling every 40 seconds, there is no communication between the detectors unless they have got some status change to report. This redundancy in the loop communication capacity is significant in terms of response time and processing time, which are reduced to a minimum.

All detectors have a built-in processor that takes care of the Dynamic Filtering Process (DYFI+). These advanced filter functions perform the following tasks:

- **Compensates for dirt and pollution** in a Smoke detector chamber and maintains the correct level sensitivity. This results in increased reliability and extends service intervals.
- **Increases sensitivity to slowly developing fires** – Ensures the earliest possible alarm in case of a smouldering fire.
- **Transients or spikes in a measured Smoke detector chamber signal are suppressed**. These are phenomena that can cause false alarms on other systems. This provides increased reliability.

4.8.3 Al_Com Loop, Hazardous Area BSD-310/ BZ-500

A number of barriers may be located in safe area with branch-off loops.



BZ-500 units can also be field-mounted. A combination of IS and non-IS detectors can be connected to the same BSD-310 loop driver module. BZ-500 Galvanic Isolators must be located in the safe area. When BZ-500 units are used in an AutroSafe IFG panel, there must be a separate addressable unit between each Isolator (segregation unit).

4.9 Detectors and Field Devices

4.9.1 Flame & Gas Detectors

Flame Detectors and IR point Gas Detectors etc. connect to PowerLoop modules, type BSD-340, each of which are capable of handling up to a maximum of 15 detectors on each PowerLoop, depending on the power consumption of the field equipment and the loop topology. The two-wire PowerLoop provides intelligent communication and DC power to the detectors.

4.9.1.1 Flame Detectors

AutroFlame X33AF PL Flame Detectors are fully integrated by means of a built-in intelligent interface featuring the OI™ function (Optical Integrity test). The detector can also provide maintenance data to the AutroSafe IFG panel. This solution includes self-diagnostic feature.

4.9.1.2 IR Point HC Gas Detectors

The AutroPoint HC300PL IR point Gas Detector is fully integrated by means of built-in intelligent interface featuring a self-test function. The detector can transmit analogue information and can also provide maintenance data.

4.9.1.3 Open Path HC Gas Detectors

AutroPath Open Path Gas Detectors are interfaced via the BN-342 interface unit. The detector is featuring an internal self-test function. The detector can transmit analogue information and can also provide maintenance data.

4.9.1.4 Duct mounted HC Gas Detectors

The AutroPoint HC300PL IR point gas duct mounted detector is fully integrated by means of built-in intelligent interface featuring a self-test function. The detector can transmit analogue information and can also provide maintenance data.

4.9.1.5 Toxic Gas Detectors

AutroTox Gas Detectors are connected to the PowerLoop by means of a 4-20mA interface unit, type BN-342. External power is not required, as the detector will be directly supplied from the loop via the BN-342 interface unit. Hot swapable sensor cells for various gas types.

4.9.1.6 Other 4-20 mA units

Any 4-20mA process transmitter unit can be connected to the AutroSafe PowerLoop via an BN-342 unit. However, devices connected by means of a 4-20mA interface will not have the ability to use the SelfVerify™ feature. Intelligent detectors with internal self-diagnostics will however be able to provide a general fault signal via the 4-20mA signal transferal in case of a malfunction.

4.9.2 Smoke, Heat Detectors and Manual Devices

Refer to the Product Catalogue 116-P-OILANDGAS/SGB for the Oil & Gas market and separate datasheets.

4.9.3 Detection Loops and Associated Detectors for Safe Areas

Interactive SelfVerify™ detectors are connected to BSD-310 Al_Com loop drivers. For a full description of loop units refer to AutroSafe's System Description (116-P-ASAFE-SYSTEMD/EGB)

4.9.4 Detection Loops and Associated Detectors for Hazardous Areas

Detectors in hazardous areas must be connected to a BSD-310 Al_Com loop driver modules via a Galvanic Isolator, type BZ-500. **Ex ia** rated detectors are available for Zone 0 and Zone 1. **Ex n** rated detectors are available for Zone 2, if required.

4.10 PowerLoop Driver BSD-340

4.10.1 Description

The *PowerLoop Driver BSD-340* functions as a protocol converter between AutroFieldBus and PowerLoop. It consists of a PowerLoop interface for power and communication, and an AutroFieldBus interface towards an AutroFieldBus Driver (AutroSafe panel internal).

The PowerLoop is a two-wire bus capable of delivering 30VDC/ 100W connected in ring topology and is galvanically isolated from the rest of the system. The PowerLoop interfaces detectors and other loop units including a 4-20mA interface.

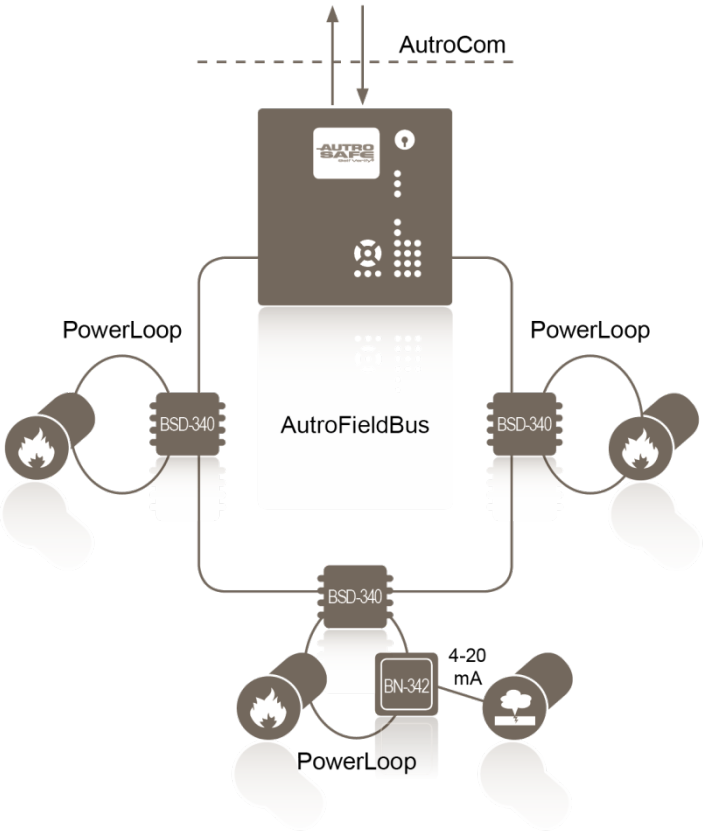
The BSD-340/1 provides a service port which is used for commissioning and maintenance.

The AutroFieldBus address is set by switches. The AutroFieldBus is normally category 5 cable.

There are three versions:
- BSD-340/1Rack mounted version
- BSD-340/2 Rail mounted version
- BSD-340/Ex Field mounted version

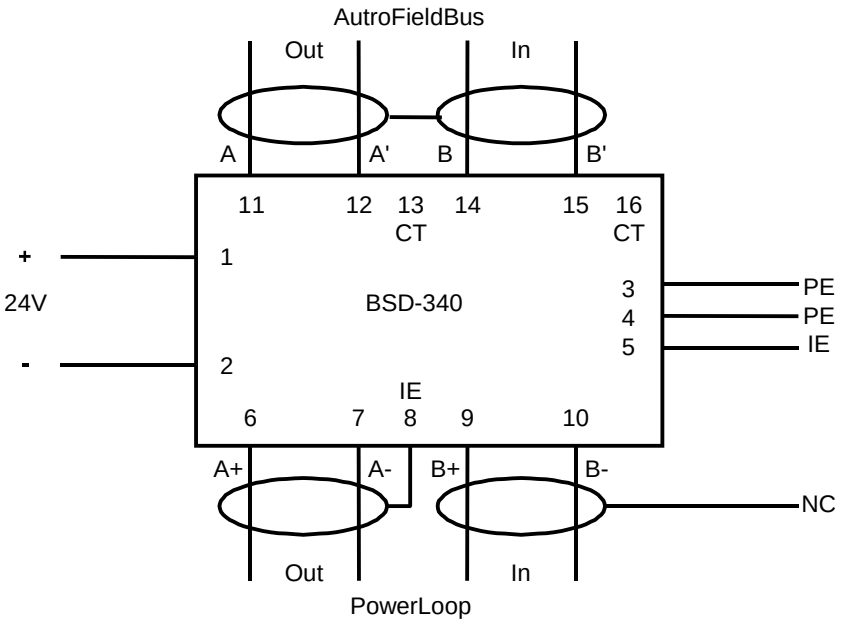
For further information, refer to data sheets.

4.10.2 Overview



4.10.3 Connections

Note:
AutroFieldBus is not polarity-dependent.
PowerLoop is polarity-dependent.



Note: “CT” is used as a reference in case segments of the AFB is left floating when Boosters or Fibre modems are used. This termination is normally left open. See “System Shielding and Earthing” in AutroSafe’s System Description (116-P-ASAFE-SYSTEMD/EGB) for further directions.

4.10.4 Earthing and Shielding

Shielded cable is required for the AutroFieldBus and PowerLoop, and the shielding shall be connected to the instrument earth (IE) at one end of the loop. Any armouring shall be connected to the protective earth (PE) at multiple points. Refer to AutroSafe’s Installation Handbook (116-P-ASAFE-INSTALL/DGB) for detailed description of shielding of cables.

4.10.5 Capacity / Limitations

Generally, the following applies:

- Maximum 15 detectors can be connected to each PowerLoop.
- May require forced cooling, dissipates up to 30W when fully loaded.
- No branches allowed on PowerLoop or AutroFieldBus.

The total power consumption to PowerLoop units, detectors and cable loss must be verified by the PowerLoop Calculator (part of the AutroSafe Configuration Tool).

- See also datasheet for BSD-340.

4.11 PowerLoop 4-20 mA Input Unit BN-342

4.11.1 Description

The *PowerLoop 4-20mA Input Unit BN-342* is a general purpose PowerLoop interface designed for third party detectors connected to the AutroSafe Integrated Fire and Gas System.

The PowerLoop is a two-wire power and signalling bus connected in ring topology and is galvanically isolated from the rest of the system.

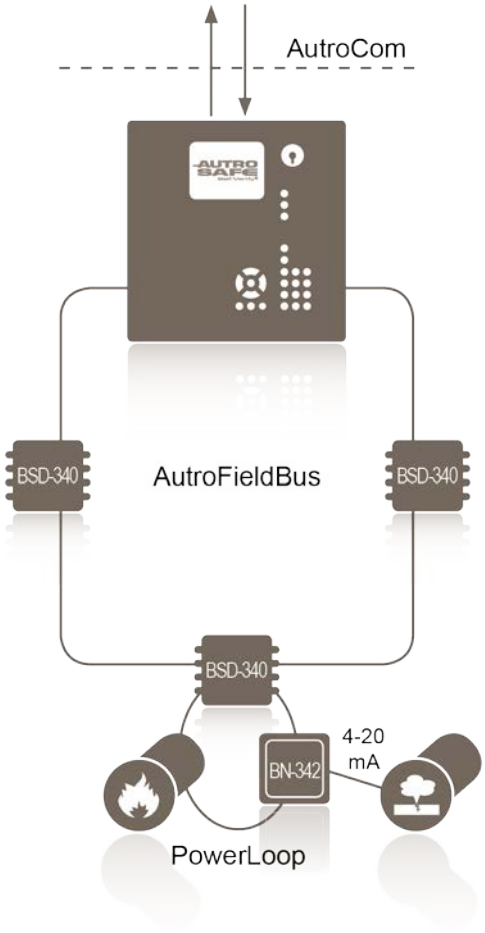
The unit communicates with AutroSafe using the PowerLoop protocol. The unit has a 4-20mA input galvanically isolated from the PowerLoop.

For further information, refer to data sheets.

4.11.2 Versions

- BN-342/EX: EEx me version including 9,5W DC/DC for external detector power supply
- BN-342/1: 19” 3U rack version, bare PCB with 19” rack front panel, no DC output
- BN-342/2: DIN rail version, bare PCB in a open DIN rail box, no DC output

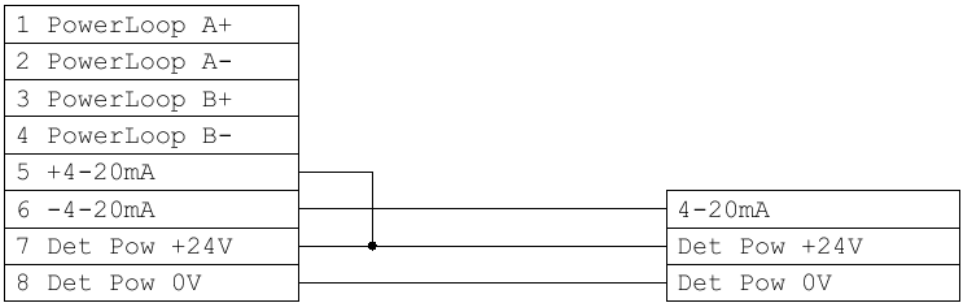
4.11.3 Overview



4.11.4 Connection – Current Source

1 PowerLoop A+		
2 PowerLoop A-		
3 PowerLoop B+		
4 PowerLoop B-		
5 +4-20mA	→	4-20mA
6 -4-20mA		
7 Det Pow +24V	→	Det Pow +24V
8 Det Pow 0V	→	Det Pow 0V

4.11.5 Connection – Current Sink



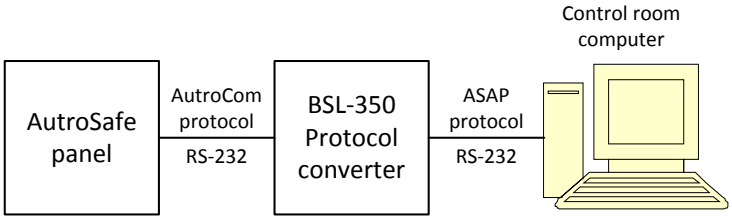
4.12 BSL-350 Protocol Converter

BSL-350 Converter is used to connect AutroSafe Panels to a Top-Level System using the ASAP protocol.

In installations where the Top-Level System does not support AutroCom interface, but has support for ASAP interface, this converter must be used.

BSL-350 Converter is mounted in between the AutroSafe panel and the Top-Level System. It will convert AutroCom messages to ASAP format.

The figur below illustrates the system topology.



The ASAP link and AutroCom link use RS-232 signal level with maximum cable length of 10 meters. For longer distances, the ASAP link can be extended by using a Current Loop Modem.

For detailed information on installation and operation, refer to section 10.

4.13 Outputs

4.13.1 Programmable Digital Outputs in Panel (BSJ-310 Module)

Discrete open collector outputs can be used for hardwired signals. BSJ-310 modules, which fit in any AutroSafe BS-420 or BC-420 panel, can be used for this purpose. In addition 24V DC relays can be supplied for each output, which will provide volt-free contacts if required. Each BSJ-310 module has eight open collector outputs. Any detector within an AutroNet network can control any output within the same network.

Delayed action and voting can be programmed for these outputs. For example such outputs can be used for the following:-

- Digital signals to the Control System (inputs)
- Digital outputs in general, for example, for shut-down signals to fire dampers, HVAC, release of extinguishing systems and signals to mimic panels etc.

4.13.2 Programmable EOL Monitored 24VDC Outputs (BSB-310)

End-of-line resistor monitored 24V DC outputs can be used to drive horns, sirens, bells, beacon and strobes etc. The BSB-310 module, which fits in any BS-420 or BC-420 panel, provides four 1A automatic fused outputs. Maximum load per module is 3A in total. Any detector within an AutroNet network can control any output within the same network. The BSB-310 outputs are specially designed for sounders and bells, thus programming facilities include a variety of options like;

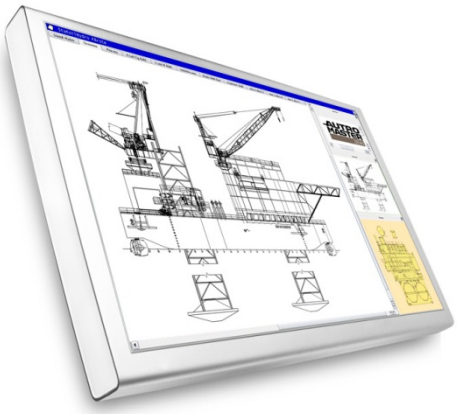
- SOLAS function (Safety Of Life At Sea)
- Delayed action
- Voting
- Digital output, monitored

4.13.3 Programmable Field Mounted I/O Units

A variety of field mounted I/O units is available for connection to the Al_Com detection loop. Some of them are shown in Chapter 4.8.2. In this example the BN-221/01 is used for fire suppression system control and monitoring. The BN-221/02 controls the horns and strobes. The BN-221/01 units provides field mounted contact rated for up to 7A. All BN-221 I/O's are EOL monitored and they require 24VDC power supply.

For information on field mounted I/O units, refer to Product Catalogue, 116-P-OILANDGAS/SGB.

4.14 AutroMaster Application/Description



AutroMaster is a *remote* monitoring and control system that enables full operation of the AutroSafe Integrated Fire and Gas system. All alarms, faults, inhibits, overrides and outputs can be monitored and controlled from AutroMaster.

If the connection between the AutroSafe Integrated Fire and Gas system and AutroMaster should go down, the AutroSafe system will operate as normal as it can function as a fully autonomous system.

The AutroMaster provides an intuitive graphical control and monitoring interface helping you to save time when every second counts.

The interface provides an overview of the monitored area (oil and gas upstream/downstream installation) in graphical form with the possibility to display and control a broad range of systems, in addition to the AutroSafe Integrated Fire and Gas detection system.

Status information is displayed in real-time with easy-to-understand graphical representation. A trend facility is available to monitor the performance of Detectors.

AutroMaster dynamically presents values for gas density, smoke and heat with different colours in the monitored area – making it easy to perform the necessary actions prior to or during a fire fighting activity.

AutroMaster provides the possibility of customer specific information in the monitored area in information layers.

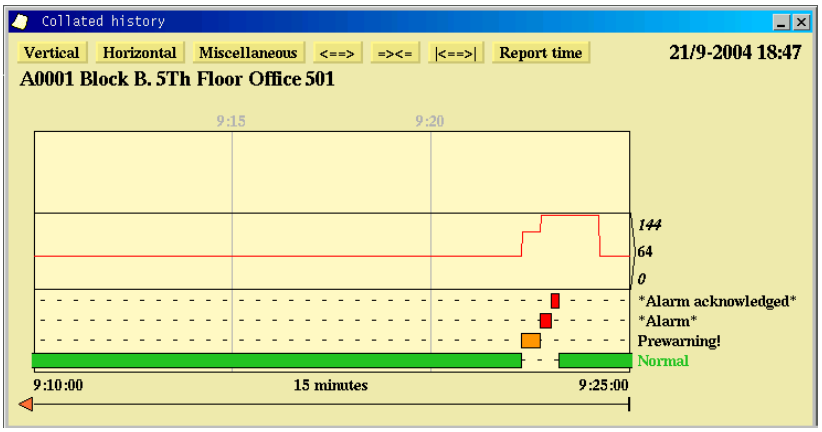
Navigation around the monitored area is easily done via the navigation pad and the use of the zoom function – giving possibility to display everything in great detail.

Power/water supply networks, sprinkler systems, emergency lights, escape routes, fire doors or any other object which may be relevant in case of an emergency can be displayed. These layers can be toggled on/off in order to simplify overviews and present only the information of interest.

The AutroMaster offers comprehensive log functionality by allowing users to create reports and logs of various properties and information from the system. Operators can create historical logs for the system and/or individual units between specified dates, analogue values read from detectors, disablement data, configuration data, version information and fault/alarm information. The report generator provides the operator with a simple method of creating a cost-effective system log for maintenance and documentation purposes.

The following options are available for report creation:

- History
  - Reports of events from the system and connected subsystems (alarms, faults, disablements, etc.) during specified periods of time
- Analogue Values
  - Reports measured values from detectors within ranges and during given periods of time
- Disablements
  - Reports on all currently disabled groups or a given group
- Configurations
  - Reports a comparison of the current configuration implemented in AutroMaster with a backed-up configuration
- Versions
  - Reports comparisons of the present configured options (symbols, functions, etc.) with backed-up configurations
- Miscellaneous
  - Generates a report without any parameters regarding alarms and/or faults



Example of detector trending in AutroMaster.

AutroMaster provides users with information about system units in terms of recorded values and events, showing development over time. This to help to indicate problems and isolate faults/sources of (unwanted) alarms.

5. IFG Functionality

5.1 Introduction

This chapter covers some of the distinctions between AutroSafe functionality for Oil and Gas panels and standard AutroSafe panels.

5.2 Inhibit Point

All loop input units can be inhibited. When one or several points are inhibited, the point(s) will not signal alarm to outputs. An inhibited point will however present an alarm, prealarm and early warning on all panels and AutroCom as usual. This includes panel buzzer, panel LEDs and panel LCD display.

It is only possible to inhibit a unit from the panel menu or via AutroCom. An inhibited point will be inhibited until the unit is un-inhibited by a manual operation or by timeout. Inhibit status will be indicated by a panel LED.

5.3 Set Alarm Limits

By using the *Set Alarm Limits* (via the menu) is possible to change a gas detector's alarm limit for *Low Alarm* and *High Alarm*.

5.4 Get Measurement Values

By using the *Get Measurement Values* (via the menu) it is possible to get analogue measurement values for a selected gas detector.

Analogue values can be monitored on the panel or on the AutroMaster.

5.5 Detection Zone Faults and Point Faults

In standard AutroSafe, a point fault is presented as a detection zone (DZ) fault; the point in fault can be accessed via the panel menu. Oil and Gas panels can also be configured to present point faults only.

5.6 Support for Common Trouble Output

The Common Trouble Output can be connected to a BSB-310, BN-310 or a BSJ-310 I/O module. The output is activated if any kind of fault occurs in the Operation Zone to which it is connected. In addition, any disablement or point inhibition within the Operation Zone will cause the unit to be activated.

5.7 Support for Gas Detectors (4-20 mA input)

The AutroSafe Integrated Fire and Gas Detection System supports the use of gas detectors that are to be connected to the PowerLoop via the PowerLoop 4-20mA Input Unit BN-342. This interface includes a user-configurable type that may be used to interface detectors with a 4-20 mA output signal.

5.8 Onboard Relay

For further information, refer to Installation Handbook, 116-P-ASAFE-INSTALL/DGB.

5.9 Support for Extinguishing Control

The Extinguishing Control Unit BN-221/01 is a digital output device which is connected to a BSD-310 or BSD-311 loop driver module via the standard Al_Com loop, by this giving full addressability to the Extinguishing equipment. The unit has two monitored inputs – one for the extinguishing media and one for the trigger gas. The unit also monitors for the presence of power supply and will give a fault warning in case of power failure or loss of power. The BN-221/01 unit has one monitored output, which is controlled by a 2-pole relay with changeover contacts. Open circuit and short circuit (including load) is detected by the output monitoring. A local isolate switch can be used to disconnect the output.

The Extinguishing Control Unit has an activation delay time which controls the period from when the activation criterion is fulfilled to when the actual activation takes place (default delay: 10 seconds). The delay is configurable and can also be adjusted and controlled from External systems. Extinguishing status and local isolate is indicated by panel LED's.

The output activation criteria is fully configurable as part of the AutroSafe C&E programming. In addition a manual activation (activation of input A on Extinguising unit) can be done.

Disable/Isolate/Override:
The Extinguishing Control Unit control its own disablement (override) state via a Field Isolate Switch. Switch activation breaks the connection between the unit output and the extinguishing agent solenoid (this is sensed by the unit output logic via a 2K EOL resistor). Activation of this switch wil disable the unit itself. In addition, activation can disable other general outputs.

5.10 Local/External Mode Functionality

Local/External functionality is selected via the AutroSafe configuration tool. As default it is switched off (Local mode only). When switched on, the system toggles between the following modes:

External mode: AutroSafe is operating together with an external system (with no communication faults). The external system is able to control extinguishing agent activation. The External mode extinguishing agent delay is controlled by a configured activation delay parameter called External Activation Delay (default delay: 60 seconds).

Local mode: An external system is disconnected and is not able to control extinguishing agent activation. The Local mode extinguishing agent activation delay is controlled by the configured extinguishing agent activation delay parameter mentioned above (default delay: 10 seconds).

5.11 Language

The panels prepared for the Oil and Gas market are available in English only (no localized-language variants exist).

NB. In order for Oil and Gas functionality to be available, “Eng. Oil & Gas” must be selected in the language menu in the AutroSafe Configuration Tool (Select Language).

6. Projecting Guidelines

6.1 General Recommendations / Planning

- Bear in mind future expansions when choosing cable dimensions, especially with regard to the PowerLoop. See Cable Specifications, 116-P-ASIFGCABLESPEC (file name asafeifgcable_cgb).
- Make sure that the PowerLoop is disabled during installation, service and maintenance.
- No branches are allowed on the PowerLoop or AutroFieldBus.
- Make sure that the detectors are evenly distributed on the available loop drivers.This provides the best possible load sharing and allows sufficient headroom for future expansion.
- Always use the PowerLoop Calculator to verify the installation before commissioning.

6.2 Typical System Configurations - Examples

Modular design allows AutroSafe to be adapted to different applications and systems. The tables below are examples with a number of panels and various detectors for typical system configurations, including:

- Floating production, storage and offloading system
- Offshore platform systems
- Land-based petrochemical system

6.2.1 Floating Production, Storage and Offloading system (FPSO)

Panels	2
Smoke detectors	230 40 EX
Heat detectors	30
Manual call-points	40
Flame detectors	80 10 CCTV
Point gas detectors	70
Open-path gas detectors	40
Toxic gas detectors	15

6.2.2 Offshore Platform Systems

Panels	4
Smoke detectors	400 160 EX
Heat detectors	30
Manual call-points	120
Flame detectors	110
Point gas detectors	150
Open-path gas detectors	60
Toxic-gas (H_2S) detector	20

6.2.3 Land-based Petrochemical System

Panels	**4**
Smoke detectors	60
Heat detectors	20
Manual call-points	280
Flame detectors	420
Point gas-detectors	360
Open-path gas-detectors	110

6.3 Mounting

For detailed information on the mounting of drivers, units and detectors for IFG, please refer to the relevant installation handbooks and the available data sheets.

The data sheets also include information on dimensions, connections/screw terminals, switch settings and LED-information.

6.4 Configuration

The configuration of all functionality related to AutroSafe Integrated Fire & Gas is described in the Help System. The Help System is an integrated part of the AutroSafe Configuration Tool.

6.5 System Shielding and Earthing

6.5.1 Introduction

The AutroSafe Integrated Fire and Gas System (IFG) has been designed to supply power and communications to advanced flame and gas detectors. The system is able to deliver up to 100W of power and uses a digital communications system, which modulates the PowerLoop at approximately 130kHz.

The PowerLoop system also allows hundreds of metres of cable to be used between the loop driver and the field equipment.

The PowerLoop concept provides the user with a potentially powerful radio transmitter and an excellent antenna. It is therefore vitally important that adequate precautions are taken to screen the signals from such an arrangement to avoid crosstalk between similar PowerLoops and also to keep the system operating within the prescribed Electromagnetic Compatability (EMC) limits.

For rules and limitations for PowerLoop installations, refer to System Shielding and Earthing, System Description, 116-P-ASAFE-SYSTEMD/EGB.

7. PowerLoop Calculator Tool

7.1 Introduction

The PowerLoop Calculator Tool is an integrated part of the AutroSafe Configuration Tool. The tool allows you to define and edit a Power Loop with a number of Loop Units.

Based on the power consumption and the cable loss, the tool presents a go/no-go test to the user. The defined Power Loop can be saved for possible changes at a later stage.

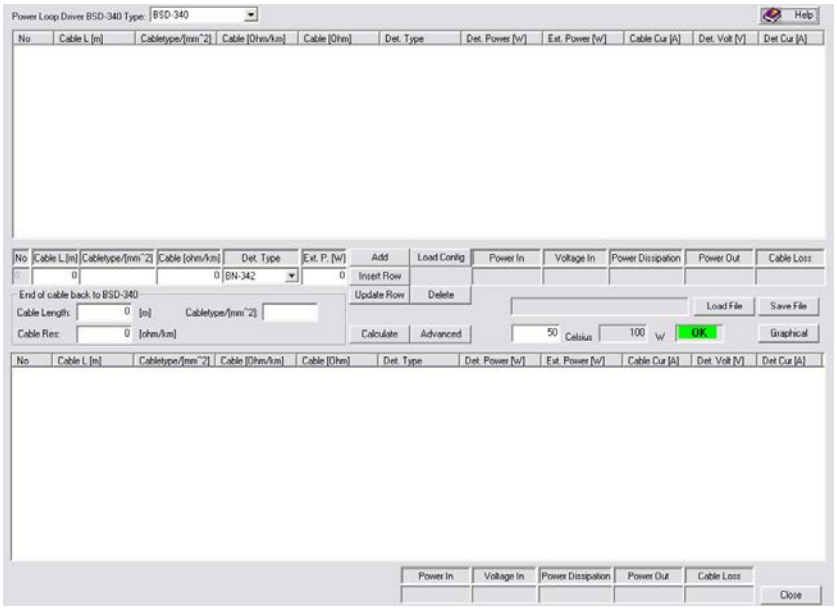
The tool can be used with loose relation to the actual configuration, based on the fact that the cabling itself is analysed. The similar mechanism is used for the Loop Calculator.

The upper part (white list box) shows the calculation assuming a break after the *last* point. The lower part (white list box) shows the calculation assuming a break before the *first* point.

Each segment of the PowerLoop is decribed by one line in the calculation sheet. The total cable segment loss is determined as a sum of cable resistance, junction loss in terminals/connectors and the internal switches in the units. The voltage calculated at each unit is actually the internal voltage after the PowerLoop isolation switches, i.e. some internal loss adds to the external cable loss.

The loss of the first cable segment includes this internal loss of the loop driver.

The calculator iterates the loop, and verifies that the total power consumption and voltage available at each loop unit is within specifications.



7.2 Operating The PowerLoop Calculator Tool

7.2.1 Loop Driver Type

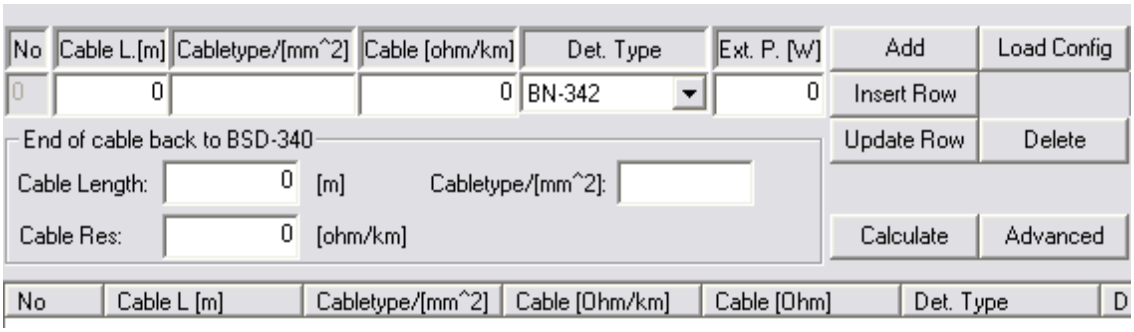
Select first the PowerLoopDriver type (BSD-340 or BSD-340/EX)

7.2.2 Add Button

- Enter the cable length and cable dimension (the dimension is for your information only).
- Enter the specified resistive loss of the cable to be used.
- Select the detector type: BN-342, X33/1, HC-300 or Junction Box.
- If BN-342/EX is selected, also enter the actual load to the external equipment/detector (supplied by BN-342/EX).

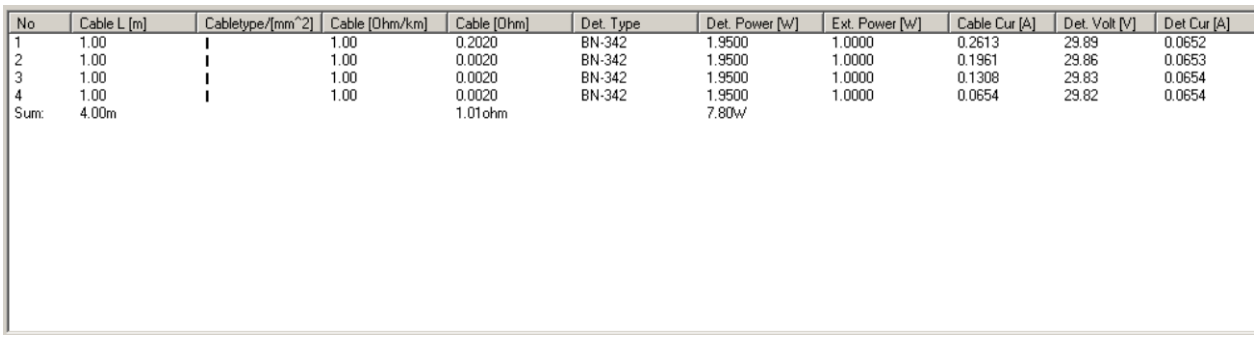
Note that if illegal float values are typed or the float value is zero, a fault warning will popup.

- Press the *Add* button and a new row will be added to the list box above.



The calculation is for break after last loop unit. Each row in the table shows the cable segment and the following detector. To close the loop (last detector to loop drive), the “End of cable back to BSD-340” field is used.

The tool calculates the current flow and voltage drop per segment into the table. Regressive calculation is used to approximate a result displayed in the list box.



No	Cable L [m]	Cabletype/[mm^2]	Cable [Ohm/km]	Cable [Ohm]	Det. Type	Det. Power [W]	Ext. Power [W]	Cable Cur [A]	Det. Volt [V]	Det Cur [A]
1	1.00		1.00	0.2020	BN-342	1.9500	1.0000	0.2613	29.89	0.0652
2	1.00		1.00	0.0020	BN-342	1.9500	1.0000	0.1961	29.86	0.0653
3	1.00		1.00	0.0020	BN-342	1.9500	1.0000	0.1308	29.83	0.0654
4	1.00		1.00	0.0020	BN-342	1.9500	1.0000	0.0654	29.82	0.0654
Sum:	4.00m			1.01ohm		7.80W				

The Power In, Power Out and Cable Loss are calculated.

Power In	Voltage In	Power Dissipation	Power Out	Cable Loss
4.28 W	24 V	0.64 W	3.64 W	0.76 W

Power In: Power supplied to the BSD-340, i. e. the total power consumption.
Power Dissipation: To find out the total power/heat budget, the dissipated power from the BSD-340 inside the rack can be calculated. Simply calculate the power dissipation by Power In minus Power Out. Then add a comment in the Help about this field, to inform of the intention.
Power Out: Power delivered to the loop from the BSD-340.
Cable Loss: Power lost in the cable. It should be observed in order to ensure efficiency in the system, this is wasted power.

7.2.3 Insert Row Button

- Select a row in the list box above to insert the new row by clicking the leftmost field.
- Enter the cable length, cable resistance (in Ohm per km), plus external power for BN-342/EX unit if necessary.
- Enter a textual description of the cable type and square area (or diameter) for information in the “cable dim/type” box.
- Select the detector type, then press the *Insert Row Button*.
  When pressing the *Insert Row Button*, the tool automatically performs a new calculation and verification.

7.2.4 Update Row Button

- Select a row in the list box above to update a row.
- Change the cable length, cable resistance (in Ohm per km), plus external power if necessary and/or detector type.
- Press the *Update Row Button*.
  When pressing the *Update Row Button*, the tool automatically performs a new calculation and verification.

7.2.5 Delete Row Button

- Select a row in the list box above to delete a row, then press *Delete Row Button*.

  When pressing the *Delete Row Button*, the tool automatically performs a new calculation and verification.

7.2.6 Load Config Button

The Power Loop Calculator dialogue is modeless, thus it is possible to do configuration while the dialogue is open. In this way, the loop data (detectors in sequence) which is entered in the System View can be loaded.

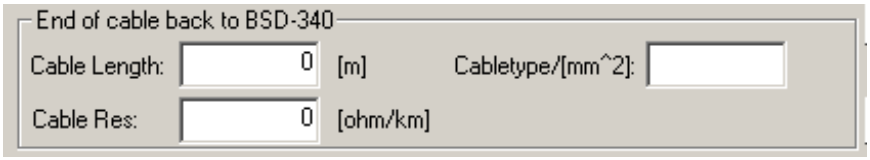
- To load a configured power loop into the Power Loop Calculator, select a Power Loop (BSD-340) in the Tree View (System View).
- Press the *Load Config Button* in the Power Loop Calculator.

The gas detectors added to the selected power loop will appear in the list box in the Power Loop Calculator with default cable length (10 m) and cable dimension (1 mm^2). The tool automatically performs a new calculation and verification.

7.2.7 Calculate Button

To describe the end of the loop, a unit “End segment” is entered – this consists of the cable segment back to the loop driver only.

- Enter the cable length and cable resistance (in Ohm per km). If illegal float values are typed or the float value is zero, a fault warning will popup.



When pressing the *Calculate Button*, the tool automatically enters values in the list box below and performs a new calculation and verification. The calculation is for break after last loop unit.

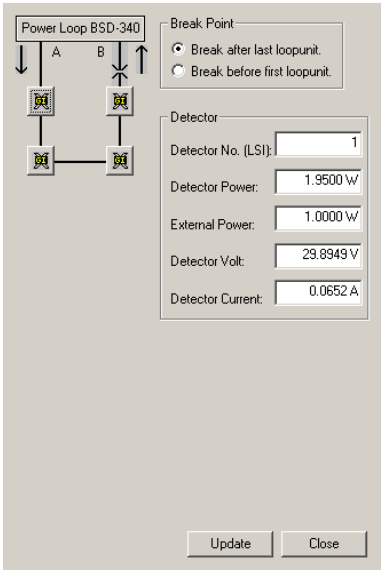
7.2.8 Graphical Button

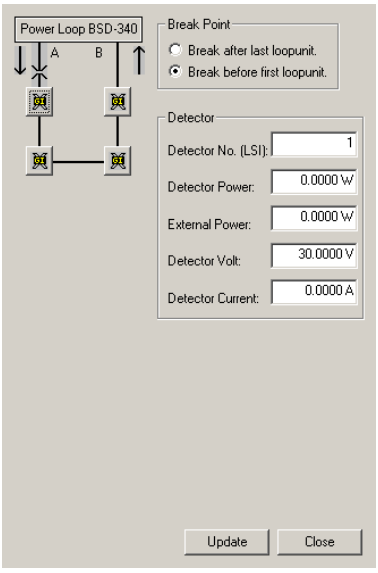
This view shows only the loop units and the cable segments. If a (or several) Junction Box is included, this will not be shown in the graphical view.

The cable segment will show only the closest cable information, causing this cable characteristics and resistance (to be observed in the view) not to be perfect. However the current flow and voltages at each loop unit will be calculated correct.

Note that it is assumed an internal resistance in the loop unit itself caused by connections and the internal electronic switches, so that the calculated voltage at the loop unit (internally) will be slightly different from what is observed at the actual external connection points.

- Press the *Graphical Button* to view a graphical presentation of the Power Loop. Two types of calculations are possible, *"Break after last loop unit"* and *"Break before first loop unit"*.
- To view the calculation in the first list box, in the Break Point area, select "Break after last loop unit" or "Break before first loop unit".
- To update the calculation in the Detector area and Cable area for *"Break after last loop unit"* , press each button in the graphical view.
- To update the calculation in the Detector area and Cable area for *"Break before first loop unit"* , press each button in the graphical view.





7.2.9 Ambient Temperature

A maximum ambient temperature of the BSD-340 Loop Driver must be entered.

The ambient temperature of the BSD-340 affects the maximum delivered power to the Power Loop.

7.2.10 Save and Load File

The data entered from the user shall be saved to a file at request of the user, and same data may be read at a later stage for editing. All data in the current sheet will be lost if a file is read (make a warning).

8. Troubleshooting

8.1.1 BSD-321

Problem / Situation / Fault message	Possible Cause	Action
Point Not responding.	The wrong protocol has been used for a detector.	
The system is sensitive to external noise / interference when, for example, lights are switched on or thermostats are activated.	Missing reference to RS-485 Break on one of the wires The RS-485 cable is too long (exceeds the maximum length).	
Only short messages are transmitted.	During initialisation a great number of messages are transmitted. Faults tend to occur more frequently. During normal operation the system will be more stable.	
Earth fault of AFB leads to communication faults.	Erronous pair connection, somewhere the CT (CT=name?) and on of the pair wires have been swapped. This may work fine, but damages communication in the event of an Earth fault.	AFB earthing and shielding: In a system that includes several AFB units, there are several options to achieve proper Earthing, and also to include earth fault detection. It is important to keep in mind the various references, sense input etc. For example, a BS-420/BC-420 is defined to sense earth faults of AFB. The shield of the AFB is tied to Earth, but the Center tap (CT) is tied to the Earth fault sense input. Out somewhere at the AFB loop a BSD-321 has tied the CT to Shield, which together make an earth fault. Isolated, per product, this is allowed as a proper installation, but not at a system view. See “System Shielding and Earthing” chapter 0, for further directions.

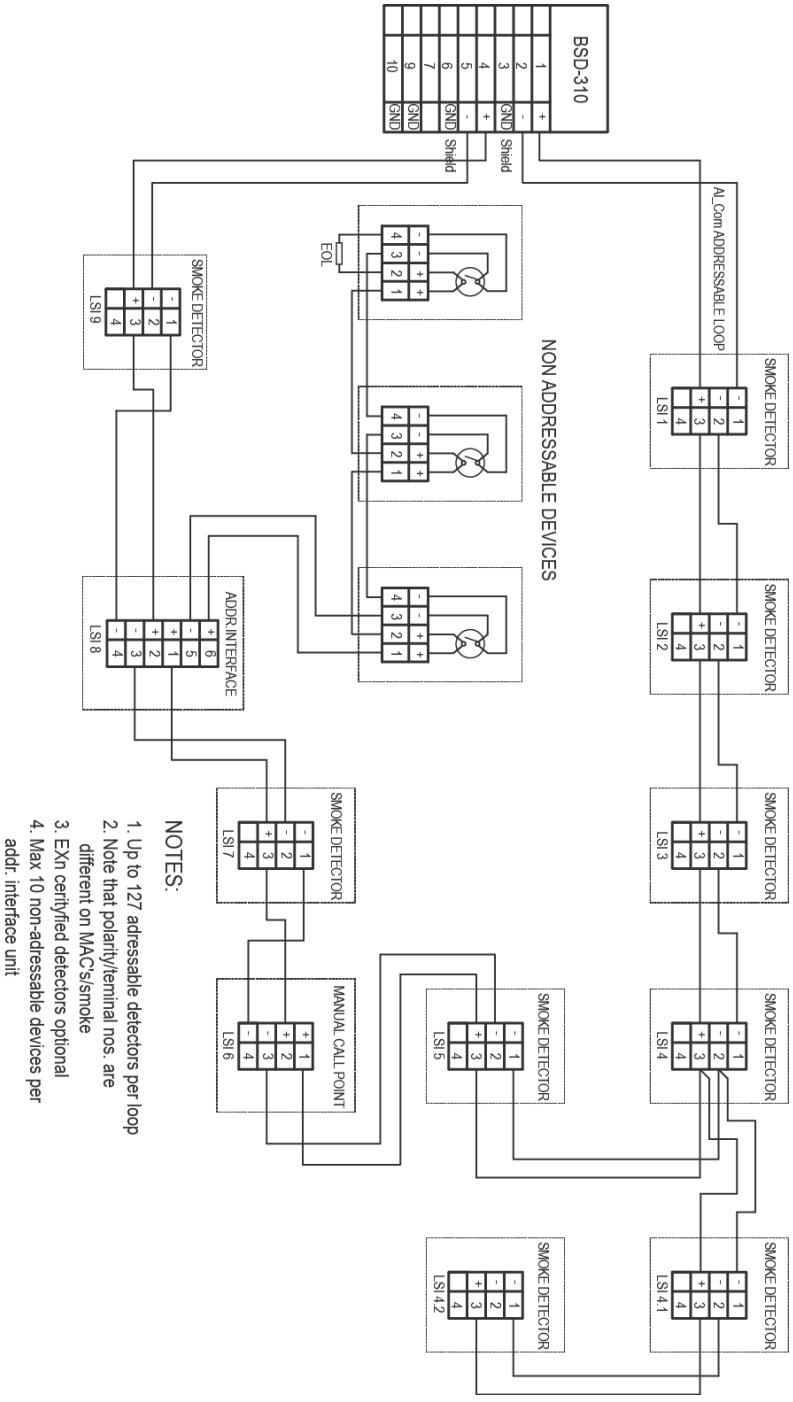
8.1.2 Examples of Fault Messages

POINT FAULTS **Fault reason**	BN-342	X33/1 PL	Simrad GD10P IR	Sieger Excel OPGD	Sieger Excel DUCT	Dräger XP Tox	Genaral BN-342
Low temp shut down	X	X	NA				
Low temp warning	X	X					
High temp warning	X	X					
High temp shut down	X	X					
Low voltage shut down	X	X					
Low voltage warning	X	X					
High voltage warning	X	X					
High voltage shut down	X	X					
CPU supply voltage monitor	X	X					
4-20mA current underrange	X	X					
4-20mA currnet overrange	X	X					
Memory fault	X	X					
General fault	X	X					
Beam blocked				X	X		
Dirty optics				X			
Overrange				X	X		
General warning					X	X	
Maintenance						X	
Oi fault		X					
Low voltage fault		X					
Temperature out of range		X					
High energy detected		X					
High energy fault		X					
Non-ratio mode fault		X					
Oi calibration fault		X					
No Oi Hi Energy Fault		X					
General fault				X	X	X	
EE checksum error		X					
Clock fault							
Flash checksum error							
ROM/EEPROM Mismatch							
RAM error							
A-D Overflow							
SPI fault							
A-D fault							
Low voltage reset fault							
WDT fault							
Early clean optics			X				
Clean optics			X				
Sensor failure			X				
User defined 1							X
Used defined x							X
User defined 15							X

9. Appendix

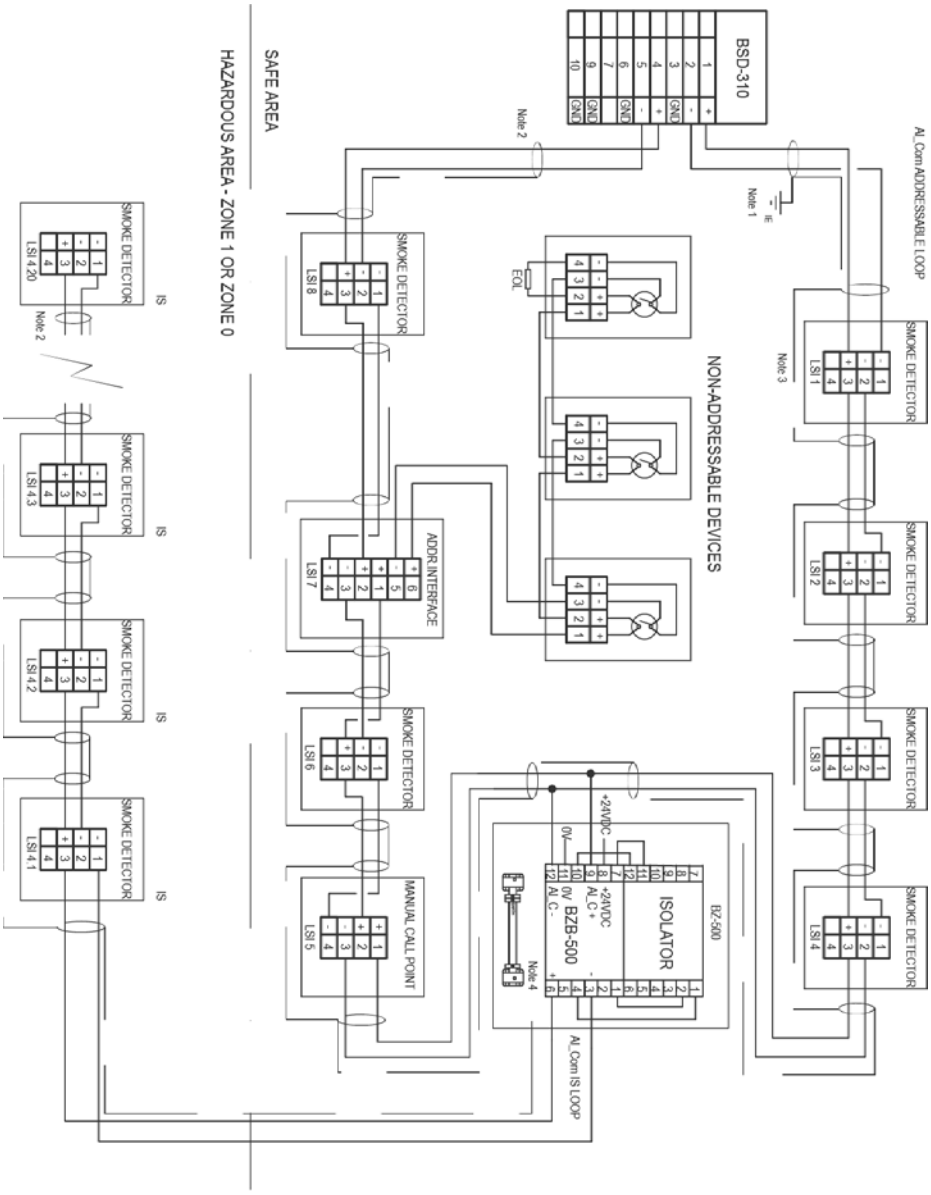
9.1 Typical Connection Diagrams

9.1.1 Al-Com Fire Detection Loop, BSD-310, Safe Area



9.1.2 Al-Com Fire Detection Loop, BSD-310, Mixed Safe & Hazardous Area

The figure below shows a flexible solution with a combined loop covering both safe and hazardous area.



SPECIFICATION:

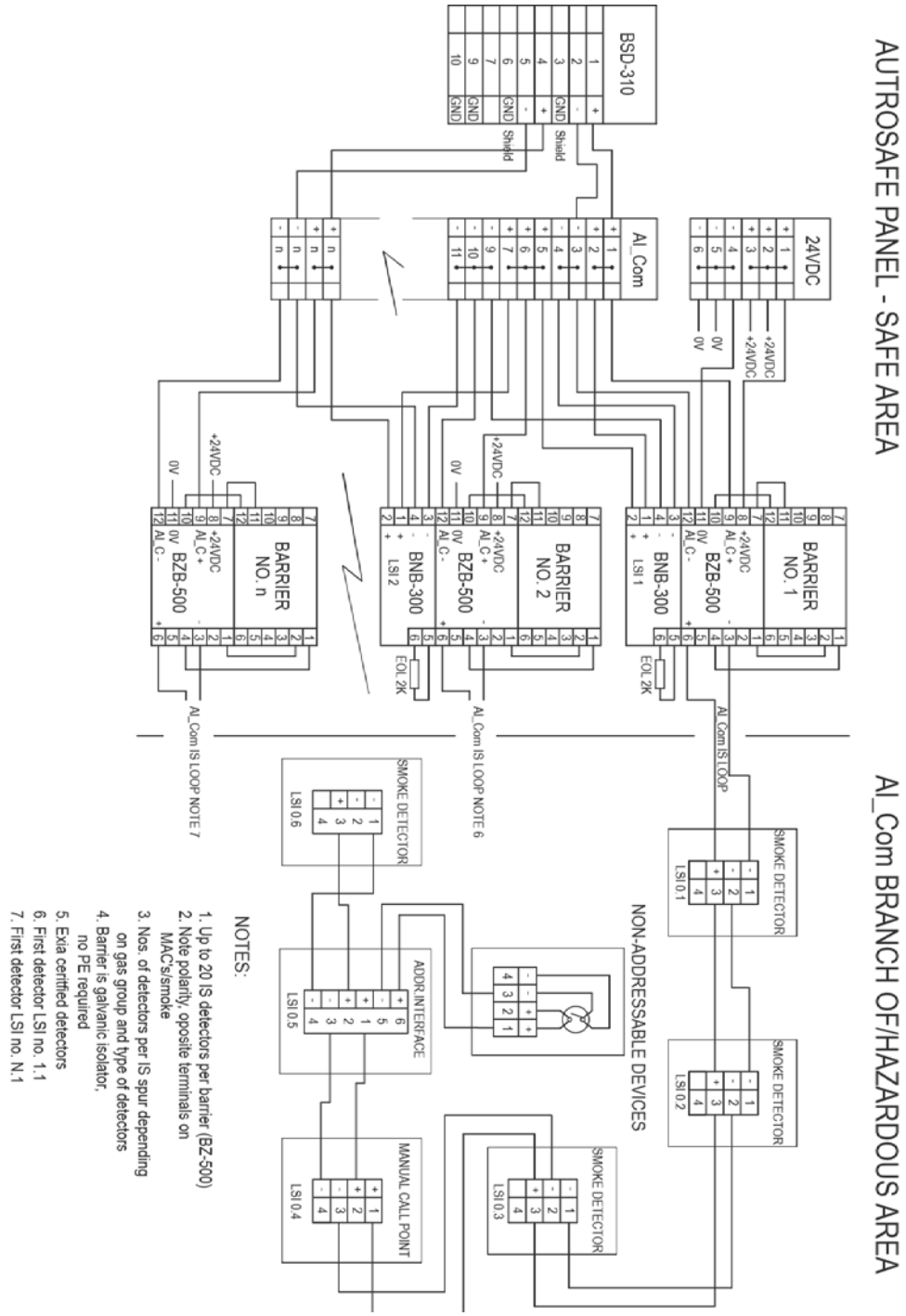
1. Up to 127 addressable detectors per loop
2. Note that polarity/terminal nos. are different on MAC's/smoke detectors.
3. EXn certified detectors optional for EX zone 2, BZ-500 isolator not required.
4. Max. 10 non-addressable devices per addressable interface unit.
5. Max. 20 IS detectors per galvanic isolator - BZ-500

NOTES:

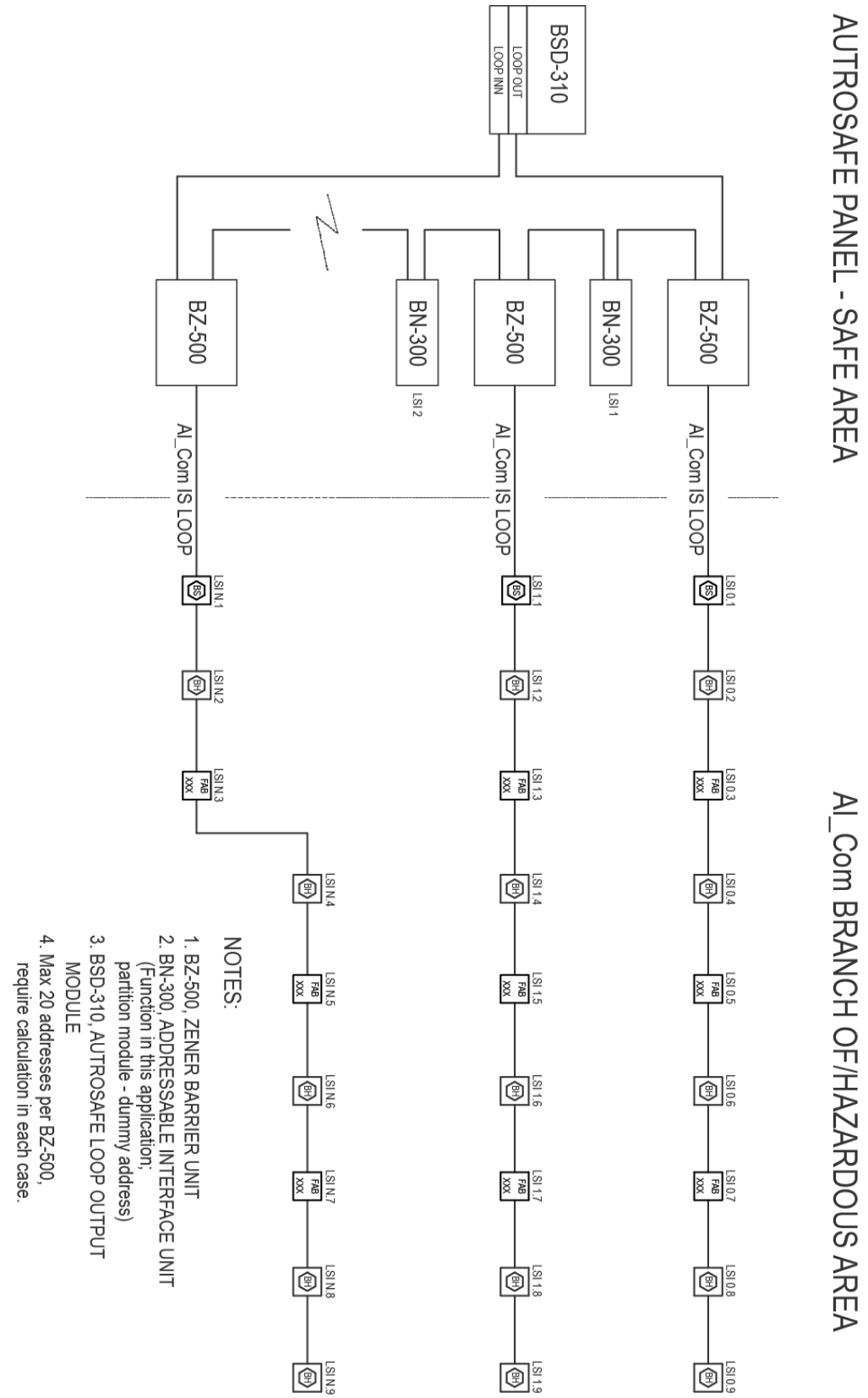
1) CONTINUOUS SCREEN, IE. FLOATING THROUGH ALL DETECTORS; ONLY ONE END CONNECTED TO IE IN CABINET.
2) LEFT FLOATING.
3) SCREEN TO BE SLEAVED AND INSULATED INSIDE DETECTOR OR JUNCTION BOX.
4) SCREEN ON IS BRANCH TO BE TERMINATED TO NEAREST IS-EARTH (IF AVAILABLE), PE-EARTH OR STRUCTURE BONDING IN SAFE AREA.

9.1.3 Al-Com Fire Detection Loop, BDS-310, Hazardous Area

The figure below shows a proposed connection diagram with the BZ-500 IS Isolators mounted in the panel. Due to the automatic addressing feature within the Al_Com loop, only one branch-off from the same point in the loop is allowed. A convenient way of designing a detector layout in compliance with the above requirements is to use the rail-mounted BN-300M addressable interface unit as a dummy address between the IS Isolators. Note that field mounted barriers is the most commonly used solution.

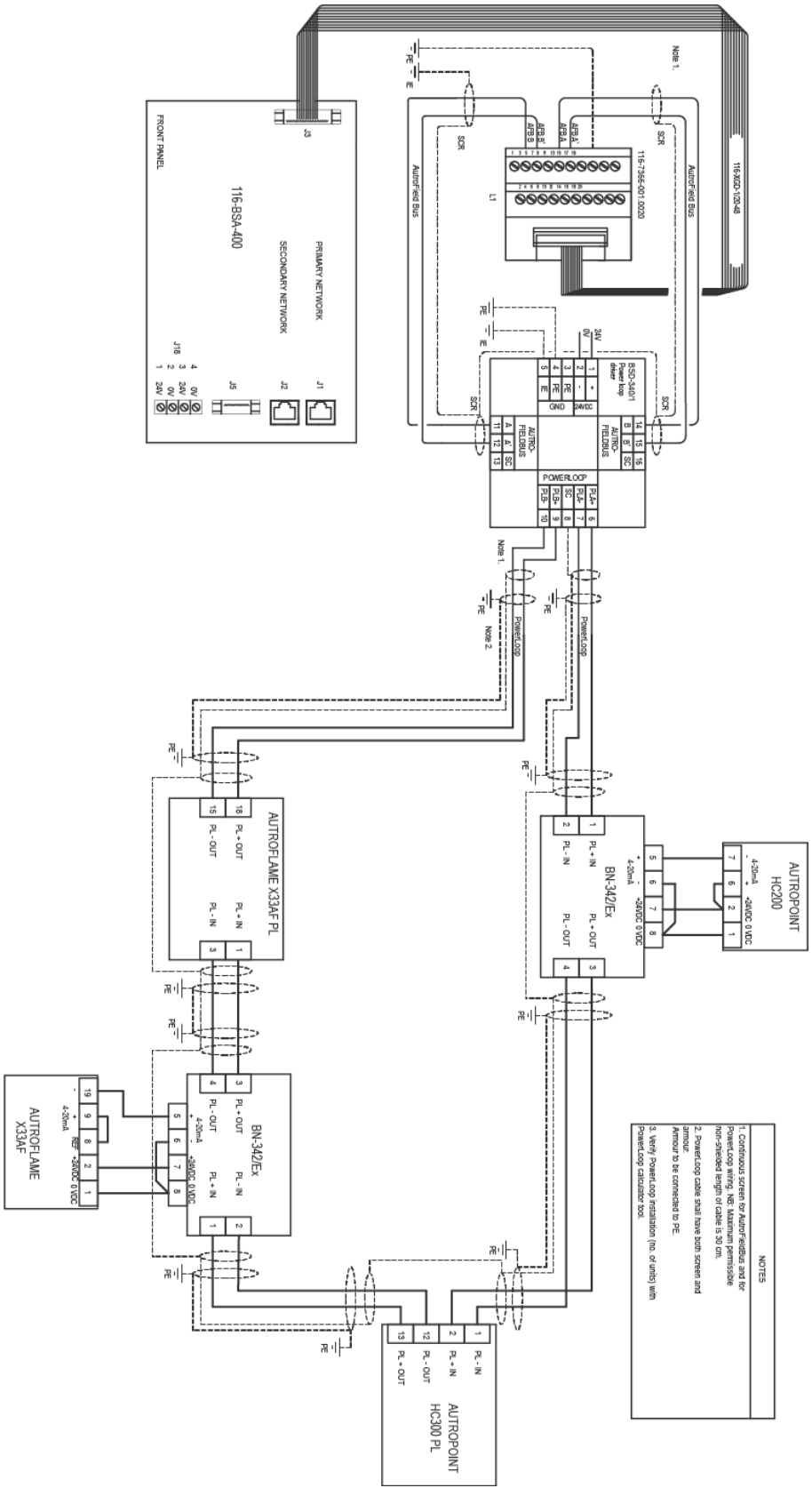


One Line Diagram - Al_Com Hazard



9.1.4 PowerLoop, BSD-340, Flame & Gas Detection Loop

Typical connection diagram - PowerLoop.



9.2 Reliability and Availability - SIL

How can we make a single-CPU-based system that is just as reliable as a dual redundant PLC-based system, and prove it by getting SIL 2 approval?

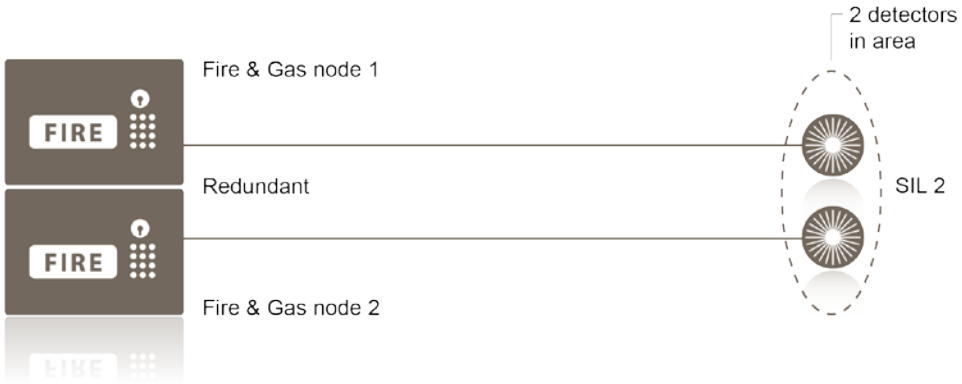
To be a little more precise: the AutroSafe system has multiple processors — there is a processor in each loop driver. In fact, every field device has a controller running the individual programs taking care of communication, *DYFI+* functions, short circuit isolator functions, etc. Furthermore, the AutroSafe system complies with all EN-54 requirements — including the specific requirement stating that no more than 512 points (detectors) should be affected by a single CPU failure.

So how do we achieve just as good — or even better — reliability and availability performance without redundant CPU's?

In "redundancy discussions", it is important to highlight some of the IEC 61508 terms, and to understand the basis for the SIL-calculations. Calculations reveal that a system is not necessarily safer or more reliable because it features redundant CPUs, redundant loop drivers or two detectors in each zone. Why?

IEC 61508 terms;
Probability of failure on demand: How likely is it that a safety function will fail when it's needed?
Fail to safe: Unhidden faults, you get to know about them in terms of a fault message from your system. (And you can take measures to compensate for the fault. E.g. put out fire guards if you lose detection in an area)
Fail to danger: Unreported faults — you don't get to know about them! (If a conventional non-addressable detector fails, it dies quietly without any fault warning — you have simply lost your detection capability and the operator is still smiling because he thinks everything is fine — these types of fault give bad SIL-figures!)

SIL 2 compliant conventional system
The traditional — and in our opinion — old fashioned and expensive approach to SIL 2 compliance is to use two nodes, and wire two conventional detectors point-to-point for every zone.



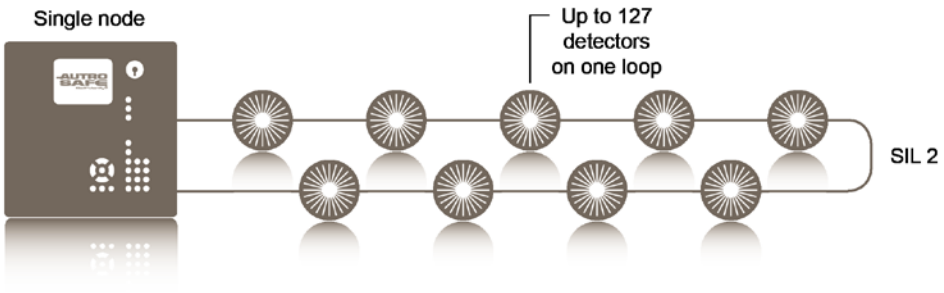
This conventional system is SIL compliant because;

- There are two detectors in each zone
- You have point-to-point wired every single detector
- The detectors are connected to two different nodes
- The system has got redundant CPU's

This provides SIL 2 compliance according to IEC 61508 (even if these conventional detectors fail to danger).

May we add that the promoters of these systems often claim that their detectors are monitored? What they usually mean is that there's a line monitoring by means of an End-Of-Line-Resistor (EOLR) — the only thing that's monitored is the loop cable; the detectors are still unintelligent devices with dry contacts that provide the alarm signal to the panel. If a detector dies, it fails to danger! Comparing this performance with AutroSafe's daily, calibrated self test of every detector; intelligent filtering of constantly measure the analogue value; "fail Safe" feature in case of loop communication failure; built-in short-circuit isolator in each field device; dual-fed loop in case of loop brake — partly explains AutroSafe's SIL 2 compliance and TÜV approval.

AutroSafe — SIL 2 Approved Analogue Addressable System:



Our assertion is that the AutroSafe concept is an intelligent, more cost-effective and generally superior approach to SIL 2 **approval** and/or a high level of availability and reliability. Simply because;

- We use intelligent detectors with a built-in automatic calibrated self-test feature, which on failure will fail to safe
- We use a loop, feeding from both ends in case of a loop break (redundancy!)
- There is a built-in short-circuit isolator in every detector or AI_Com field device preventing a single failure from affecting the loop or adjacent field devices
- We use high quality, reliable components throughout the system providing high-end figures SIL calculations
- We have "fail-safe" loop communication function on the AI_Com, providing an alternative alarm signal route if loop communication dies (Redundancy!)
- Interactive detectors mean that change in the analogue signal — the signal measured in the detector chamber — is transferred when it occurs. In addition, a safety polling of each detector takes place every 40 seconds — just to make sure every device is alive and working.

This is the way we have built our system to make it SIL 2 compliant, compliance that has been confirmed by our TÜV certification. Compared to a conventional dual-CPU-based system, it is a different approach. Calculations and real life operation shows that using this new approach allows us to achieve the high level of system availability that is expected, and sometimes even better!

Do you want a "fail-to-safe" system that tells you if something goes wrong, a system proven by SIL 2 certification to be just as reliable as a dual redundant conventional system?

Or do you want an "expensive to install and maintain", old-fashioned system that requires comprehensive manual tests and inspection to maintain operability?

9.3 Operation and Maintenance – What Do You Gain with AutroSafe?

Why should you choose an addressable system with analogue detectors as opposed to a conventional non-addressable system? What do you gain in by using an AutroSafe system?
There are of course some obvious gains, for example, the detectors are monitored, and hence you know they are working!
Less obvious maybe, but just as important is the information you get when something is wrong.
Let us do a comparison between a conventional and an analogue addressable system for the most common fault scenarios:

Type of fault/Event.	Potential consequence of event:	Conventional System Fault warning or Alarm:	AutroSafe Analogue Addressable System, Fault warning or Alarm:
Fire detector fault — detector out of operation	Undetected fire.	No warning	WARNING ON ADDRESS.
Sensitivity fault (too low or too high)	Undetected hazard or false alarm. Unnecessary shut down and stop in production.	No warning	Automatic compensation. Fault or pre-warning , if beyond limits. Full detection capability maintained.
Short-circuit in loop	Some conventional systems give full alarm on short circuit, may cause unnecessary shut down and stop in production.	Fault warning or full alarm – loop is out of operation, you've got no detection.	Fault warning — no degrading of detection capability. Loop is fully operational.
Loop break	Lost detection capability.	Fault warning — degraded detection capability on most systems	Fault warning — no degrading of detection capability.
Gas detector fault	Lost detection capability.	4-20mA provides some fault reporting	Detailed information. Exact reason for fault reported
Flame detector fault	Lost detection capability.	4-20mA provides some fault reporting in the range 0-4mA	Detailed information. Exact reason for fault reported
Non-fire scenarios causing unwanted alarms	Unnecessary shut down and stop in production.	Fire Alarm	No alarm — suppressed by DYFI+, full detection capability maintained.
Pollution of fire detectors	Undetected hazard or false alarm. Unnecessary shut down and stop in production	No fault warning. Unwanted fire alarm if over sensitive.	No alarm, no fault — Compensated by DYFI+, fault message or pre-warning if beyond limits
CCTV Flame detector		NA — not available on conventional systems.	Detailed information. Exact reason for fault reported

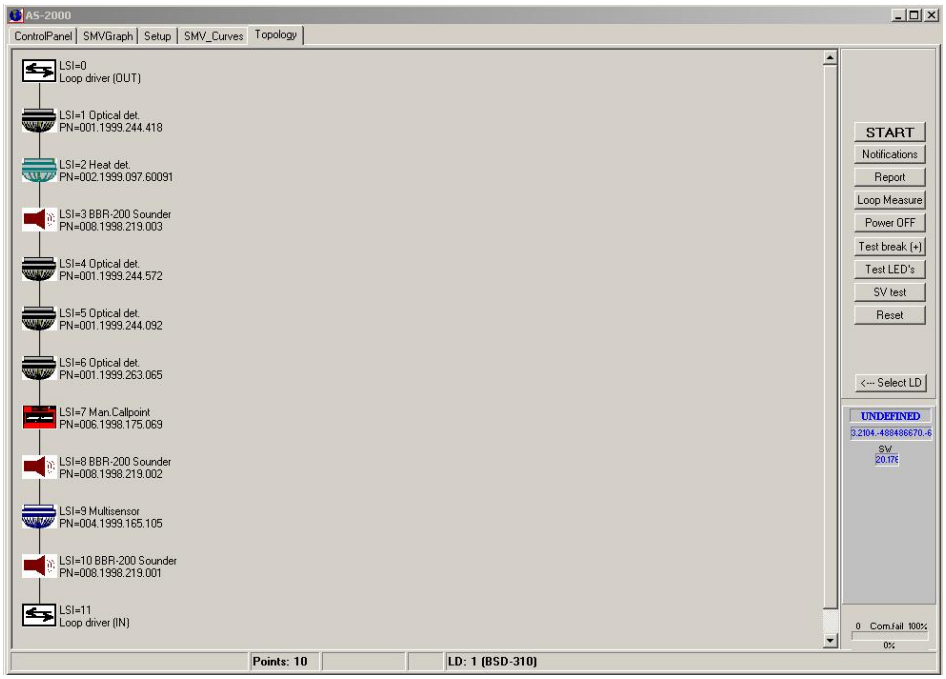
The following figures are screenshots from a software simulator showing the level of detail of fault messages you get from fully integrated AutroSafe detectors. Needless to say, maintenance personnel will save time because they will know exactly what's wrong! And, for the same reason, the operator will stay on top of the situation.

9.4 Configuration and Software Tools

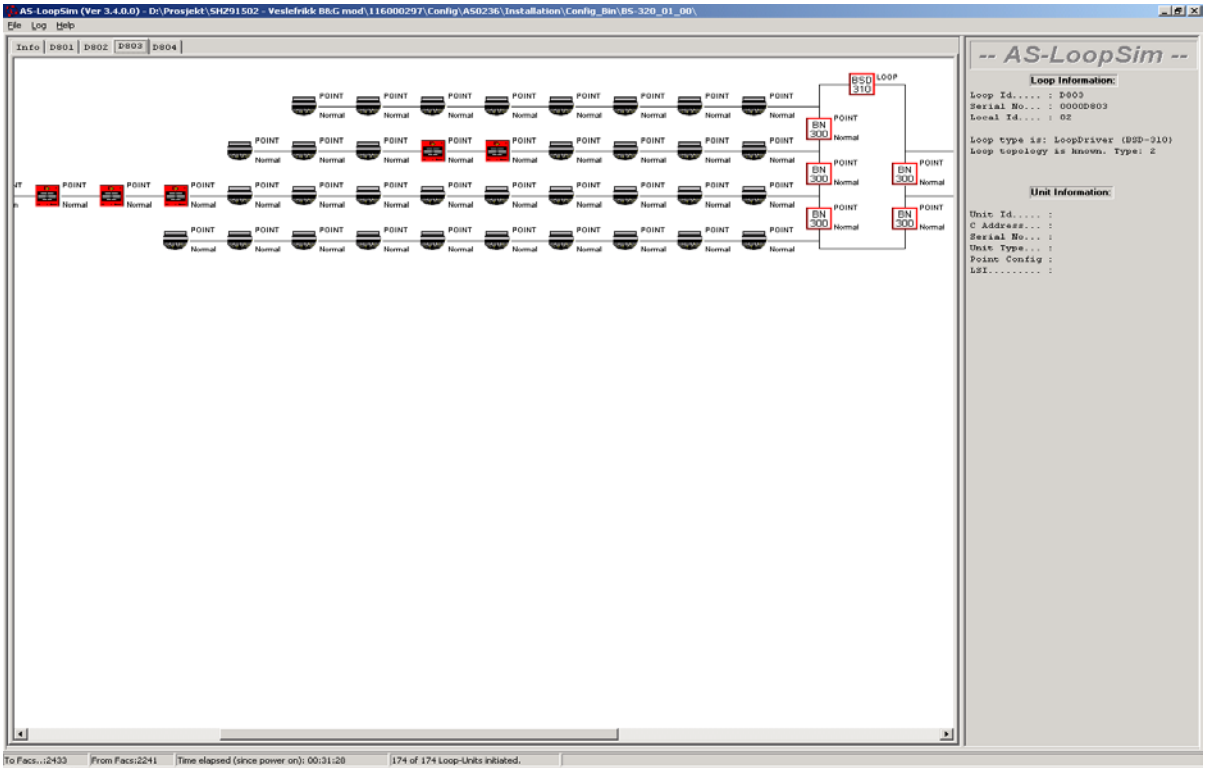
The package of user-friendly software tools covers all your needs for design and calculations, configuration, simulation, tests and logging. All Autronica AutroSafe IFG applications run on all Windows platforms.

9.4.1 AutroSafe Software Tools

AS-2000 Loop Diagnostics Tool, reading loop layout and all detector data in real-time:



Simulator for I/O modules and Detection Loops:

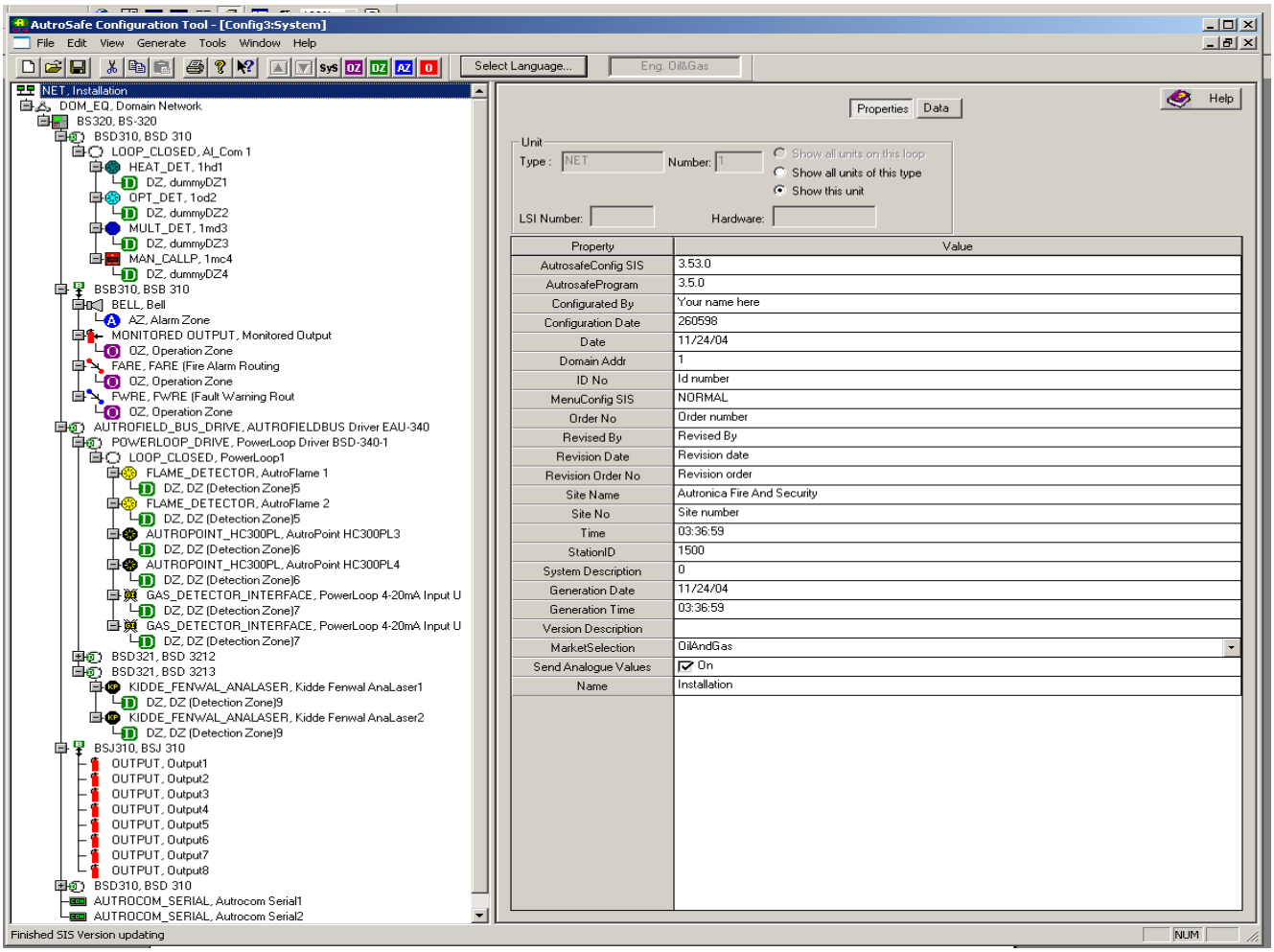


LoopSim is an excellent tool for C & E tests. Simulation features for all type of detectors and status of all outputs makes this tool ideal for every FAT.

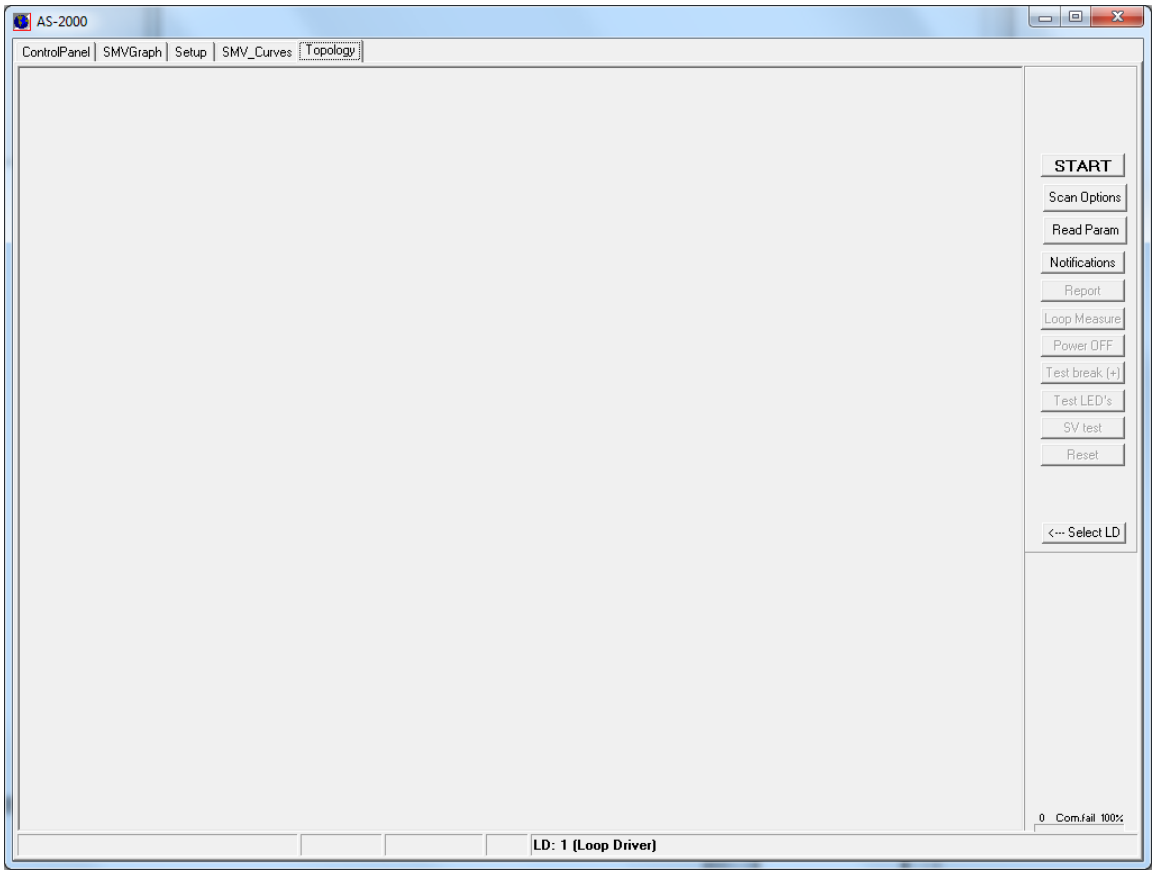
Configuration

The windows-based configuration tool covers all type of applications whether it is a big multi panel network — or a single panel standalone system.

Excel files with I/O and detector information can, with minor modifications, be imported into the configuration tool. A loop diagnostics tool called AS-2000 can read all information from a detector loop and generate an import file, thus saving you both time as well as reducing manually entering detector information.
AutroSafe Configuration Tool:


AutroSafe Configuration Tool - [Config3:System]
File Edit View Generate Tools Window Help
Select Language...
Eng. Oil&Gas
NET, Installation
DOM_EQ, Domain Network
BS320, BS-320
BSD310, BSD 310
LOOP_CLOSED, AI_Com 1
HEAT_DET, 1hd1
DZ, dummyDZ1
OPT_DET, 1od2
DZ, dummyDZ2
MULT_DET, 1md3
DZ, dummyDZ3
MAN_CALLP, 1mc4
DZ, dummyDZ4
BSB310, BSB 310
BELL, Bell
AZ, Alarm Zone
MONITORED OUTPUT, Monitored Output
OZ, Operation Zone
FARE, FARE (Fire Alarm Routing
OZ, Operation Zone
FWRE, FWRE (Fault Warning Rout
OZ, Operation Zone
AUTROFIELD_BUS_DRIVE, AUTROFIELDBUS Driver EAU-340
POWERLOOP_DRIVE, PowerLoop Driver BSD-340-1
LOOP_CLOSED, PowerLoop1
FLAME_DETECTOR, AutroFlame 1
DZ, DZ (Detection Zone)5
FLAME_DETECTOR, AutroFlame 2
DZ, DZ (Detection Zone)5
AUTROPOINT_HC300PL, AutroPoint HC300PL3
DZ, DZ (Detection Zone)6
AUTROPOINT_HC300PL, AutroPoint HC300PL4
DZ, DZ (Detection Zone)6
GAS_DETECTOR_INTERFACE, PowerLoop 4-20mA Input U
DZ, DZ (Detection Zone)7
GAS_DETECTOR_INTERFACE, PowerLoop 4-20mA Input U
DZ, DZ (Detection Zone)7
BSD321, BSD 3212
BSD321, BSD 3213
KIDDE_FENWAL_ANALASER, Kidde Fenwal AnaLaser1
DZ, DZ (Detection Zone)9
KIDDE_FENWAL_ANALASER, Kidde Fenwal AnaLaser2
DZ, DZ (Detection Zone)9
BSJ310, BSJ 310
OUTPUT, Output1
OUTPUT, Output2
OUTPUT, Output3
OUTPUT, Output4
OUTPUT, Output5
OUTPUT, Output6
OUTPUT, Output7
OUTPUT, Output8
BSD310, BSD 310
AUTROCOM_SERIAL, Autrocom Serial1
AUTROCOM_SERIAL, Autrocom Serial2
Properties
Data
Help
Unit
Type : NET
Number: 1
Show all units on this loop
Show all units of this type
Show this unit
LSI Number:
Hardware:
Property
Value
AutrosafeConfig SIS 3.53.0
AutrosafeProgram 3.5.0
Configurated By Your name here
Configuration Date 260598
Date 11/24/04
Domain Addr 1
ID No Id number
MenuConfig SIS NORMAL
Order No Order number
Revised By Revised By
Revision Date Revision date
Revision Order No Revision order
Site Name Autronica Fire And Security
Site No Site number
Time 03:36:59
StationID 1500
System Description 0
Generation Date 11/24/04
Generation Time 03:36:59
Version Description
MarketSelection OilAndGas
Send Analogue Values On
Name Installation
Finished SIS Version updating
NUM

AutroSafe Configuration Tool – Loop calculator:



10. AutroCom/ASAP Protocol Converter BSL−350

BSL-350 Converter is used to connect AutroSafe Panels to Top-Level System using the ASAP protocol.

BSL-350 Converter is mounted in between the Top-Level System and the AutroSafe panel. It will convert AutroCom messages to ASAP format.

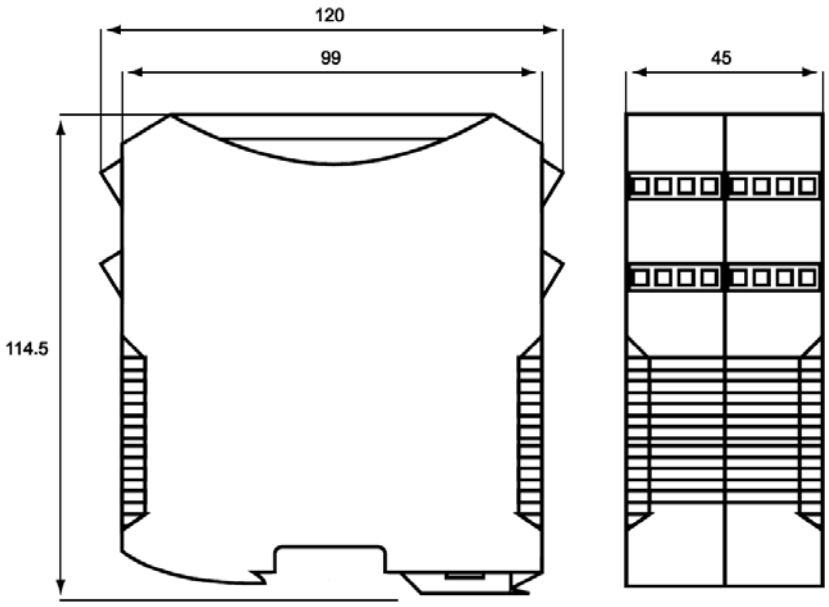
10.1 Installation

10.1.1 Mechanical mounting

BSL-350 Converter can be mounted on standard 35mm DIN rails.

When mounting the converter close to other equipment, make sure the ventilation grates are not covered by other equipment. These must be open to ensure proper air cooling of the electronics.

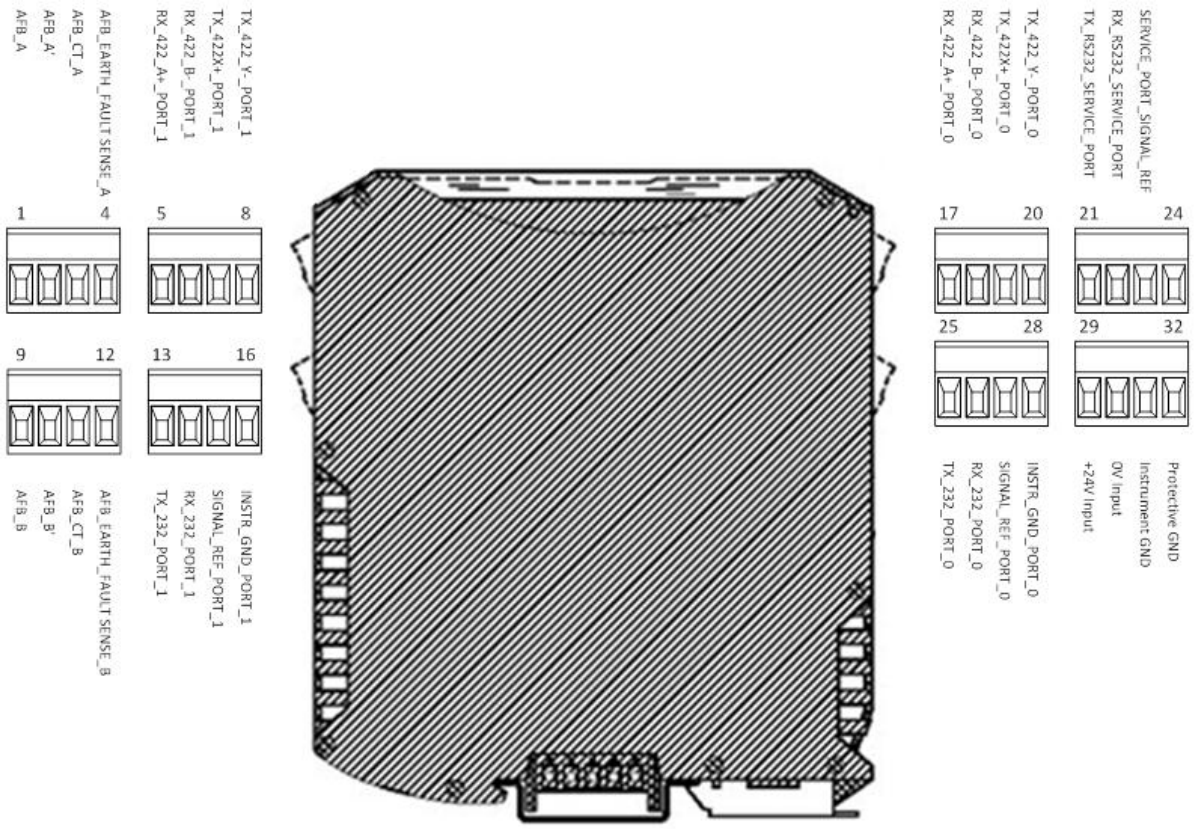
The figure below illustrates the mechanical dimensions.



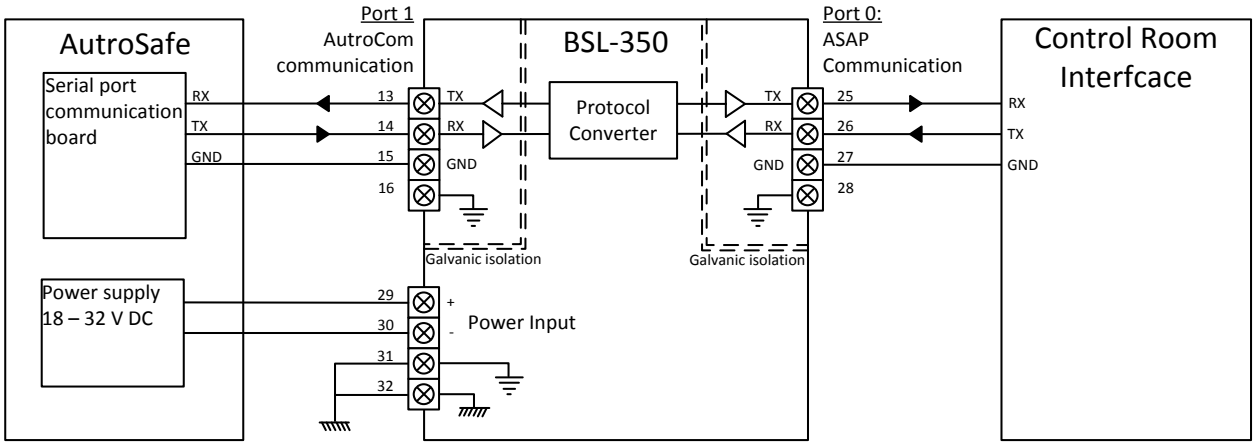
10.1.2 Electrical Connections

Before the cables are connected to the BSL-350 Converter, it is recommended to turn off the power supply to the converter.

The figure below shows the numbering of all screw terminals.



The figure below shows a typical connection of the BSL-350 Converter.



10.1.2.1 Power supply

BSL-350 Converter has the following power requirements:

Input voltage range:	18 – 32 V DC
Minimum current supply:	250 mA

Terminal connectors:

Terminal no.	Name	Description
29	Power +24V DC	Power input. Nominal 24V DC.
30	Power Ground	Power ground.

10.1.2.2 ASAP Communication

The ASAP Communication wireing connects the BSL-350 Converter to the Top-Level System. The ASAP Communication wires are connected to Port 0 on the converter.

ASAP Communication use RS-232 signal levels. In order to select the correct signal level, the DIP Switch S1 pins must be set to the following positions:

DIP Switch S1 pins	Port 0 setting for RS-232
1	OFF
2	OFF
3	OFF
4	ON
5	OFF
6	OFF
7	OFF

ASAP Communication in RS-232 mode:
When using RS-232 mode, max cable length is 10 meters.

In RS-232 mode, 2 signal wires plus ground is used. The table below lists the wiring connections to the converter:

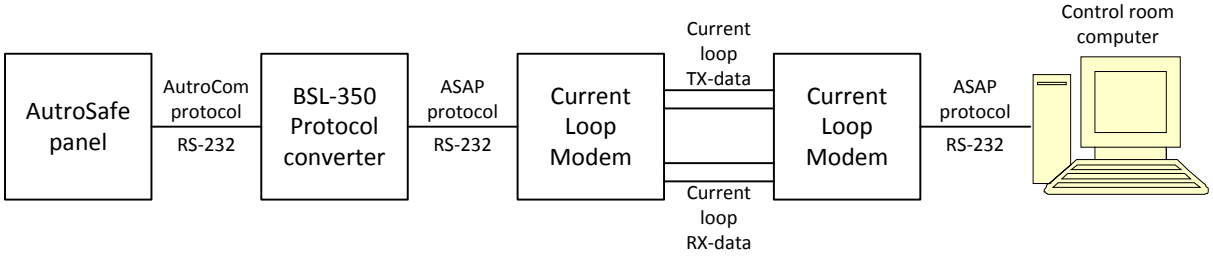
Terminal no.	Signal Name	Description
25	ASAP TX	Data signal from Converter to Top-Level System.
26	ASAP RX	Data signal from Top-Level System to Converter.
27	ASAP Ground	Common ground between Converter and Top-Level System.

ASAP Communication using 4-20 mA current loop modem:
In order to support ASAP Communication longer than 10 meter limit set by RS-232, a current loop modems has to be used.

The current loop modem must support RS-232 interface and separate loops for TX-data and RX-data. Autronica recommands current loop modem type MD-21 produced by Westermo.

The current loop modems is installed between the BSL-350 Converter and the Control Room computer interface. The modem's RS-232 interface must be connected to the ASAP interfaces on both sides. Note that the modem must be installed with separate current loops for TX-data and RX-data. See the current loop modem's installation manual for installation instructions.

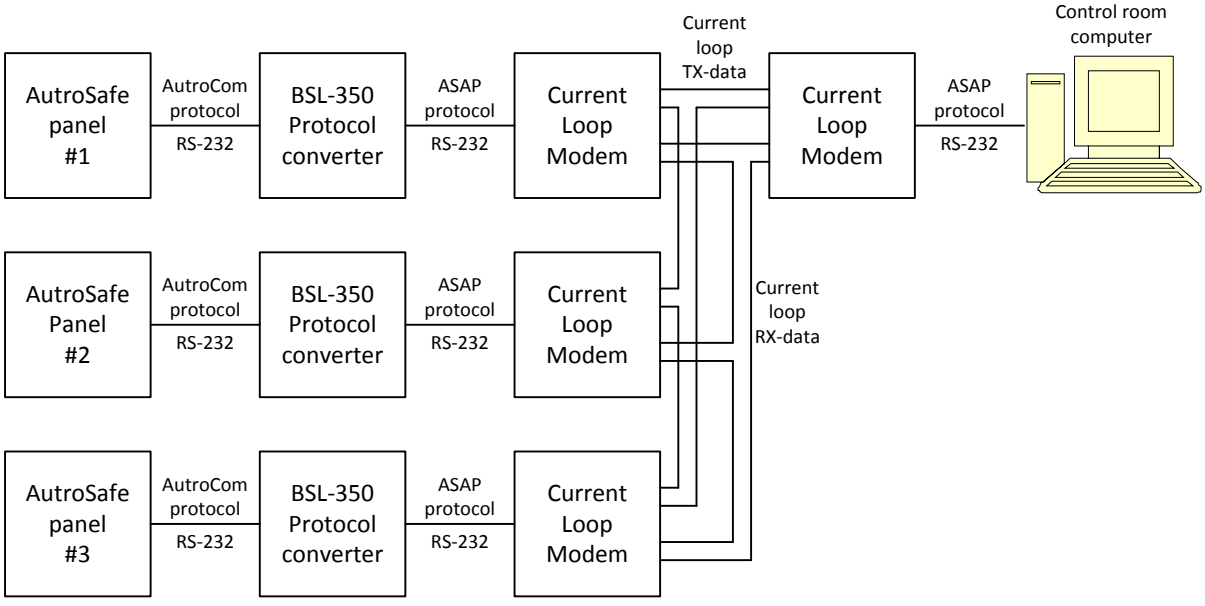
The figure below illustrate an AutroSafe panel connected to the ASAP interface in the Control Room via current loop modems.



ASAP Communication in multi-drop configuration:
The ASAP Communication Protocol supports multi-drop configuration, where one ASAP link can be connected to several AutroSafe panels. To use the multi-drop feature, current loop modems has to be used.

Connection of ASAP Communication to the current loop modem will be similar as described in previous section. The modem must be installed with separate current loops for TX-data and RX-data.

The figure below illustrates a multi-drop configuration, where three AutroSafe panles has been connected to one ASAP net.



10.1.2.3 AutroCom Communication

The AutroCom Communication wiring connects BSL-350 Converter to the AutroSafe panel.

ASAP Communication use RS-232 signal levels. In order to select the correct signal level, the DIP Switch S2 pins must be set to the following positions:

DIP Switch S2 Pins	**Port 1 setting for RS-232**
1	OFF
2	OFF
3	OFF
4	ON
5	OFF
6	OFF
7	OFF

For wire connection at the AutroSafe side, see AutroSafe installation handbook.

When using RS-232 mode, max cable length is 10 meters.

In RS-232 mode, 2 signal wires plus ground is used. The table below lists the wiring connections to BSL-350 Converter:

Terminal no.	Signal Name	Description
13	AutroCom TX	Data signal from the converter to AutroSafe panel.
14	AutroCom RX	Data signal from AutroSafe panel to the converter.
15	AutroCom Ground	Common ground between converter and AutroSafe panel.

10.2 Configuration

10.2.1 General introduction

The AutroCom communication protocol and the ASAP communication protocol use different address systems for the detector and loop addresses. The BSL-350 Converter needs to know the AutroSafe UnitIDs and the BS-100 detector numbers.

Before the converter can operate, it must be configured with mappings data between these two address systems.

10.2.1.1 Tools requirement

Two PC application tools are needed to do the configuration:

- AutroSafe Configuration Tool
- AutroComTest, version 4.7.0.5 or newer

10.2.2 Procedure overview

At installation, the BSL-350 Converter has to be configured. The configuration is a three-step process:

1) **Prepare AutroSafe configuration**
   First, the AutroSafe configuration has to be prepared. To prepare the AutroSafe configuration the AutroSafe Configuration tool is used. If a configuration already exists it can be modified or a new configuration has to be created. This step can be conducted at the office before the installation.

2) **Build BSL-350 Configuration file**
   In this step the AutroSafe configuration from AutroSafe Configuration Tool is parsed and the BSL-350 Converter configuration file is generated. The AutroComTest tool is used for this purpose. This step can be conducted in the office.

3) **Download BSL-350 configuration file**
   The configuration file must be downloaded to the BSL-350 Converter unit. To download the configuration the AutroComTest tool has to be used.

It is simplest to perform all steps at the same time, but it is possible to prepare the configuration in office and download it in the field also. This is described at the end of this chapter.

10.2.2.1 Warning

If the AutroSafe configuration is changed, the BSL-350 Converter must be re-configured. If the configuration between AutroSafe and the converter is different, the converter will stop operating. This is to prevent the converter to operate with an obsolete configuration.

10.2.3 Prepare AutroSafe configuration

10.2.3.1 Overview

Basically, this step consists in adding additional information to the AutroSafe configuration. What is needed is to add additional ASAP loop and ASAP detector numbering to the AutroSafe configuration. This information is put in the Name field for each loops and detectors.

If the BSL-350 Converter is part of a system upgrade which will replace BS-100 panels with AutroSafe panels, and no AutroSafe configuration exists yet, a new configuration has to be created.

If an AutroSafe configuration already exists, this configuration can be used.

10.2.3.2 System design rules

The BSL-350 Converter is designed to be used in an AutroSafe system that is a one-to-one copy of the BS-100 system. The following rules apply:

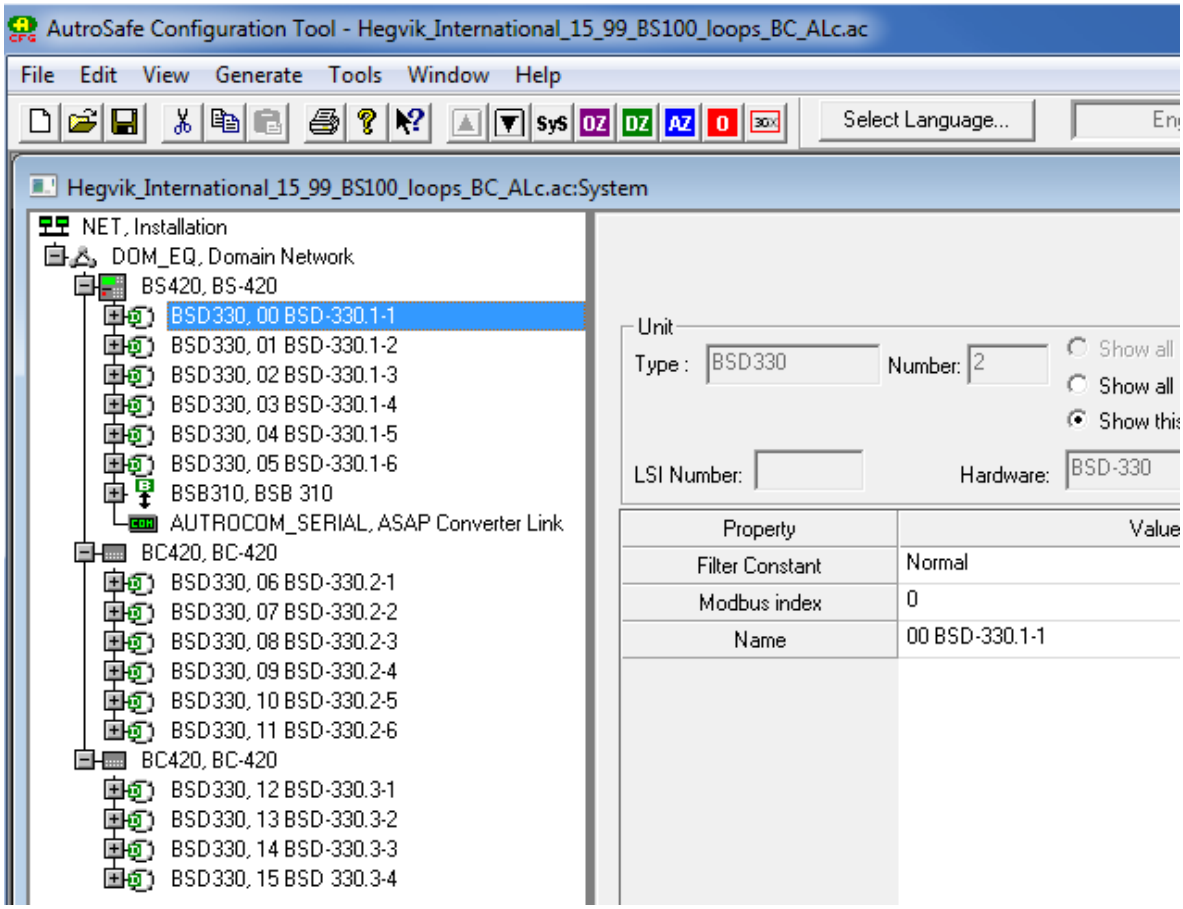
- The largest possible BS-100 configuration has 16 loops.
  In an AutroSafe system each panel can have max 6 loops, so a network of e.g. one BS-420 and two Controllers (BC-420) is required.
- A BS-100 system has no Operation Zone (OZ) concept.
  In AutroSafe there must be only one OZ, named OZ1.
- In AutroSafe detectors are organized in Detection Zones, (DZ). The DZ name is shown on the panel when there is a fire, fault etc. The detector name is shown as additional information. To emulate BS-100, each detector must have its own DZ.

The loops must be numbered from 00 to 15.
The detectors must be numbered from 0001 to 1599.

The AutroSafe uses a so-called UnitId internally, which holds no information about loops nor detector position. The BSL-350 Converter needs to know the BS-100 style detector numbers, so this information must be entered in the AutroSafe config tool as part of the detector and loopdriver name strings.

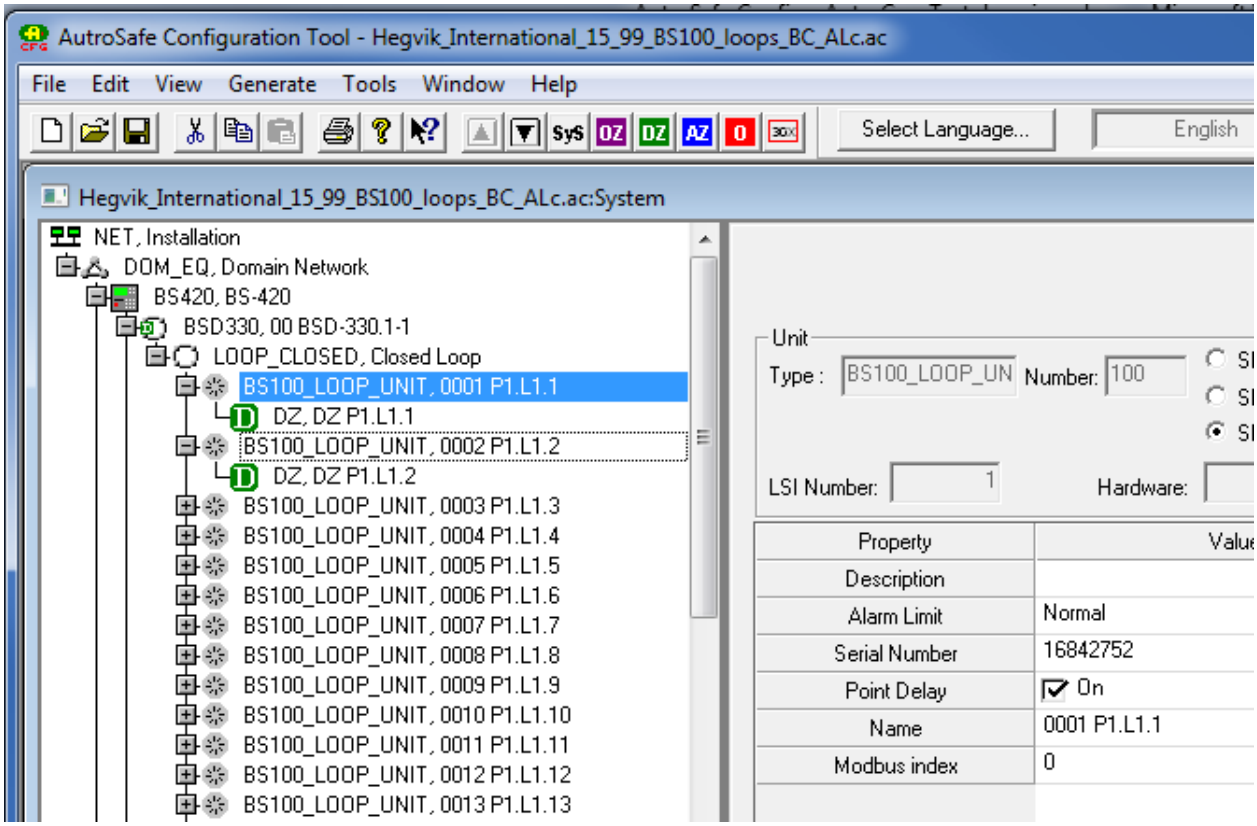
10.2.3.3 Adding loop and detector information

Below is an example of a 16-loop system. The BS-100 loop number is encoded as the two first characters of the loopdriver names.
Note that AutroSafe must have some I/O module for functions like FARE (alarm to fire department), bells etc. These are logical loops, but must NOT be given BS-100 style loop numbers (must NOT have numeric digits in the two first positions in the name).



Below is an example of how detectors are organized under a loopdriver.

Each detector name must begin with a 4-digit number,where the two first digits are the loop number (00..15), and the two last digits are the detector number within the loop (01..99)
Note that there are no restrictions related to DZ names.



10.2.4 Build BSL-350 configuration file

After AutroSafe configuration has been prepared, the AutroComTest is used to build the BS-100 configuration file.

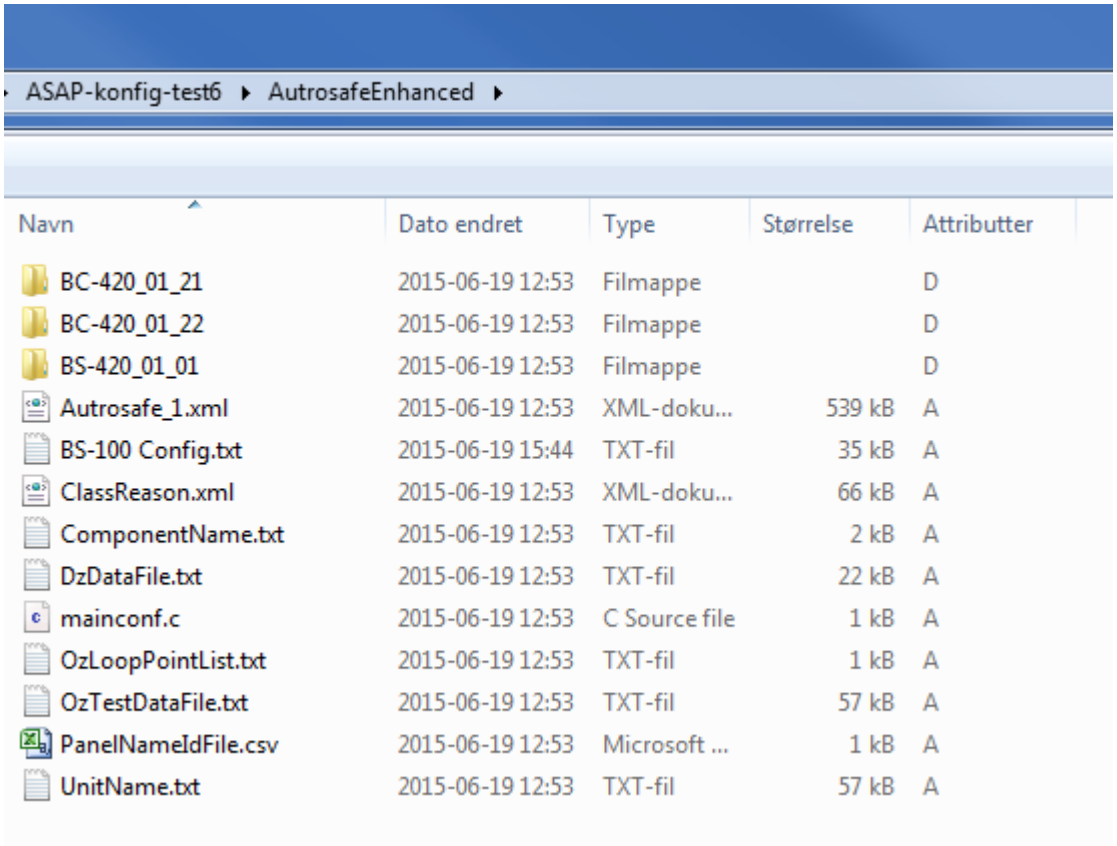
10.2.4.1 Files in use

AutroConfig saves the AutroSafe configuration in several files.

When building BS-100 Configuration file, AutroComTest reads information from the following AutroSafe configuration files, Unitname.txt and Autrosafe_1.xml. These files contain, among other information, the Unit Names for each loops and detectors prepared by the AutroSafe Configuration Tool.

The BSL-350 configuration file is put in the AutrosafeEnhanced sub-directory under the directory where your AutroSafe config is stored. The file is by default named “BS-100 Config.txt”.

Optionally, the user can also save the generated configuration in its own configuration file. This is required if the configuration is prepared in office and has to be downloaded from another computer in the field.



10.2.4.2 Configuration Download Cable

The Configuration Download Cable is used to download the configuration file from the PC running AutroComTest to the BSL-350 Converter.

The Configuration Download Cable has Autronica Part No. XJA-039.

Before the AutroComTest tool is started the cable must be connected between the computer and the BSL-350 Converter.

On the BSL-350 Converter, the Configuration Download Cable must be connected to Port 1, screw terminals 13 to 15, which under normal operation is connected to the AutroCom Communication cable to AutroSafe panel. In case this port is already connected with this AutroCom Communication cable, it must temporarily be unconnected. After the configuration has been completely downloaded, remember ro reconnect the AutroCom Communication cable.

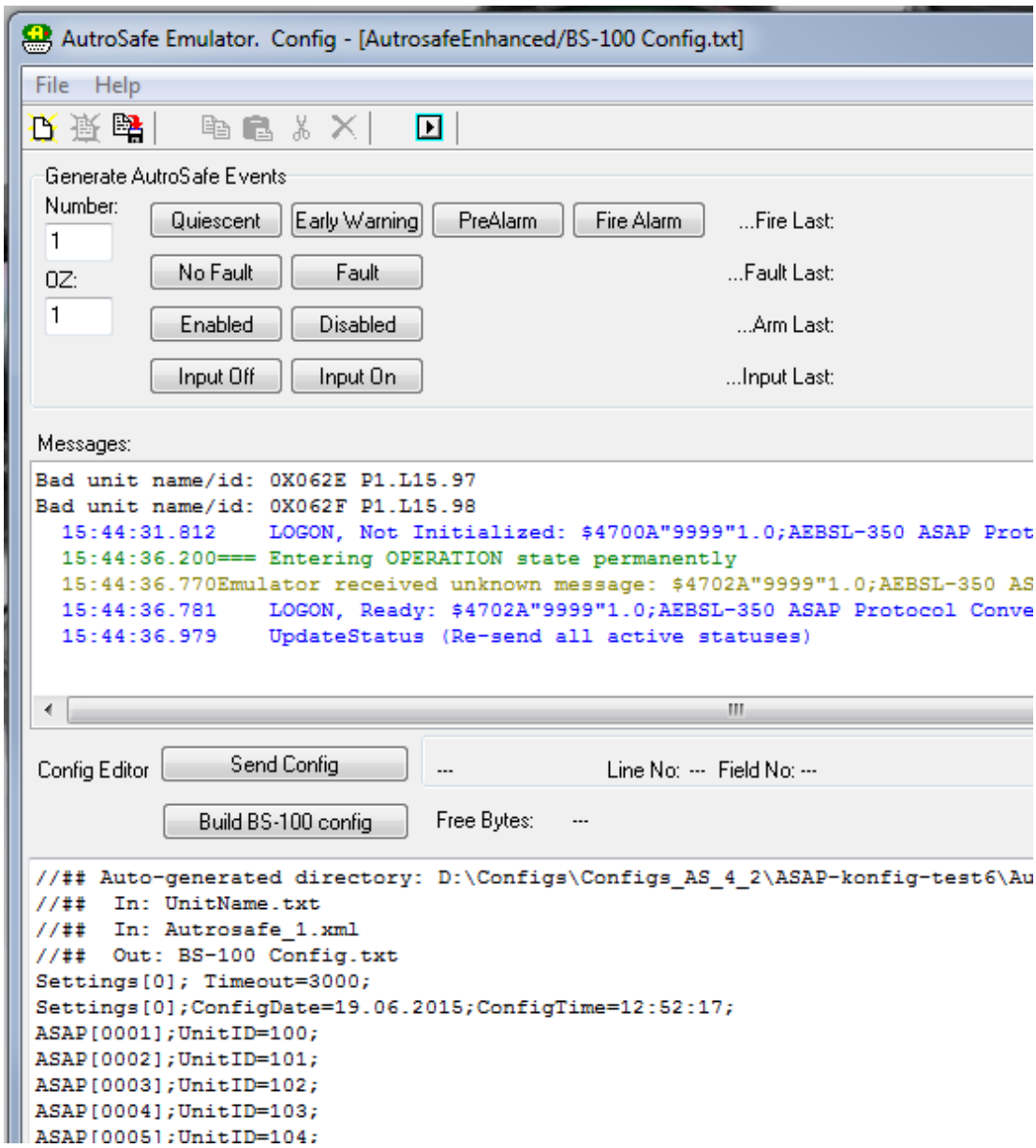
On the PC running AutroComTest, the Configuration Download Cable must be connected to a 9-pin D-Sub RS-232 serial port. If the computer does not have a RS-232 port, an USB-to-RS-232 interface converter can be used in between.

The Configuration Download Cable is using RS-232 signals levels. 2 signal wires and ground is required by, TXD, RXD and Ground. Table below lists these signals and the connection of it:

Computer RS-232 pin connection pin no.	**BSL-350 Converter terminal connections**	**RS-232 Signal name**	**Description**
2	13	RXD	Data signal from BSL-350 Converter to PC
3	14	TXD	Data signal from PC to BSL-350 Converter
5	15	Ground	Ground

10.2.4.3 Start AutroComTest application

- Start AutroComTest
- In the Settings Menu, select “Com port and protocols…” For Link layer select “Serial Sliding Window”. RS232 port settings is 9600,8,N,1.
  (there will be some communication trace, e.g. Log_on_request periodically).
- In the Tools menu, select “AutroSafe emulator”:
  A new window opens. It initially simulates an AutroSafe start-up, and responds to the logon.
- The emulator window has a “Message” field, which displays progress info, and a “Config editor” field where the BSL-350 converter config will come.



10.2.4.4 Configuration building

- Click the “Build BS-100 config” button.
  A “Open file” window is shown, in the directory you last ran AutroSafe config. If this is correct (you see the UnitName.txt from your config), clock “Open”, else navigate to the correct location.
- As soon as the file is opened, the conversion runs and fills in the Config Editor.
- During conversion some information may be written to the “Messages” field.
  - E.g. the BSB-310 IO module(s) will be observed as not having a proper loopdriver name, but that is actually correct.
  - If you have detector names with typing errors (not numeric digits in the 4 first positions) they will come here also (see the example).
- If any error occurs, you may have to go back to the AutroSafe Configuration Tool and make corrections.
- Note that the ConfigDate and ConfigTime is filled in automatically. This info will be checked by the BSL-350 converter every time it starts up connected to AutroSafe to be certain that the converter has the same config as the panel.
- The setting “Timeout” can be modified.

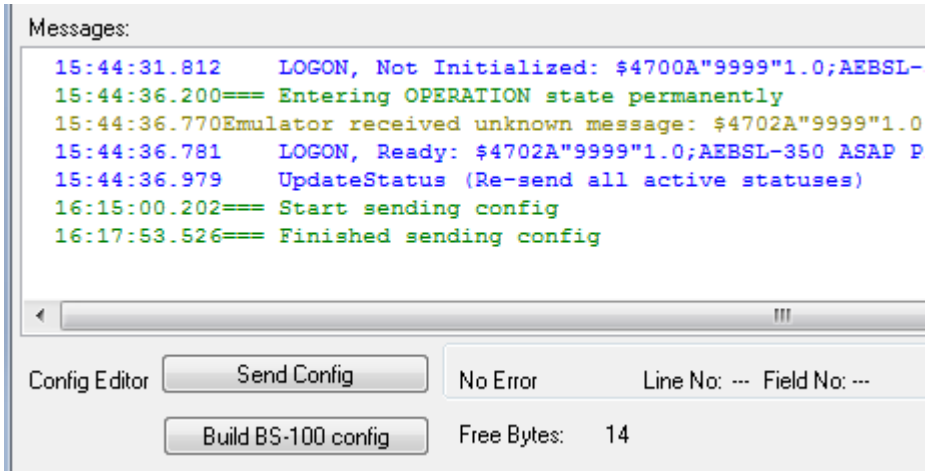
10.2.5 Configuration downloading

After the BS-100 configuration file has been generated with no errors, it's time to transfer it to the BSL-350 converter.

10.2.5.1 Download procedure

It is assumed that AutroComTest is already running and connected as described in 10.2.4.2 and 10.2.4.3. If not, repeat the steps described in these two sections.

- Click the "Send Config" button.
  The "Free Bytes" text shows a number that decrements.
  The main window of the AutroComTest program shows messages flowing rapidly.
  Note that the "Config Editor" is saved as a file named "BS-100 Config.txt" in the same directory you read UnitName.txt from.
- If you messed up the config manually you may get a message with "LineNo" and "FieldNo".
- When upload is finished, it's shown in the Messages.



10.2.5.2 Testing

While the AutroComTest is connected to the BSL-350 Converter it's possible to do some simple testing with the connected top-system. The AutroSafe Emulator window has some test buttons "Fire Alarm", "Fault" etc. These cause events related to the UnitId set in the small edit box to the left labelled "Number" (initially no. 1).

10.2.6 Separate conversion and upload

This is basically the same procedure as above, except that the built "BS-100 Config.txt" file is saved at the office and read again at the installation.

10.2.6.1 At the office:

- Prepare the AutroSafe config and generate it.
- Start the AutroComTester, and open the AutroSafe Emulator window
- Click the "Build BS-100 Config" button and open UnitName.txt
- When the "Config Editor" field has been filled in, just do **File menu, Save.**
  The editor now has been saved as "BS-100 Config.txt" in your config directory. (Alternatively, use "Save as…").
- (Possibly copy the "BS-100 Config.txt" file to an USB memory if you are going to use another PC at the customer's site…)

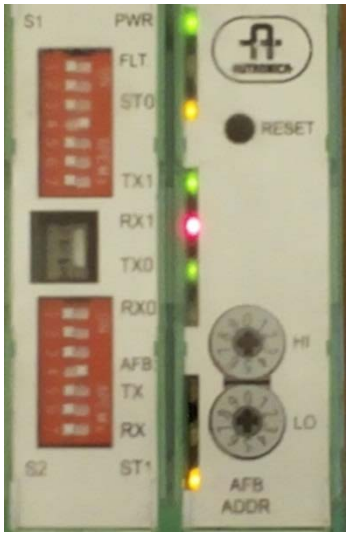
10.2.6.2 At the customer's site:

- Connect the PC's serial port to the BSL-350 Converter's AutroCom port
- Start the AutroComTest.exe, open the AutroSafe Emulator window
- Do **File menu, Read…** to read the "BS-100 Config.txt" file into the Config Editor.
- Click "Send Config" to start the transfer.

10.3 Operation

10.3.1 Front panel functions

The front panel is protected by two plastic cover lids. The front panel is normally only needed to access during installation and configuration.



DIP Switch S1 and S2
The DIP Switches S1 and S2 (The switch rows with 7 positions) are used to configure the serial port communication.

Service port connector
The 3 pins connecter between the two DIP Switches is the Service Port.

This port can be used to read out data logs from BSL-350 Converter and software upgrading. This port shall only be used by Autronica authorized personnel.

Reset button
The reset button will restart the converter. Press this button after new configuration file has been downloaded.

Note that this Reset button is not the same reset function as the Reset button found on the AutroSafe front panel

After the converter has restarted, due to power-on start-up or reset button pressed or any other causes, the FLT LED will blink and a fault message will appear on AutroSafe panel. This is normal and the purpose is to indicate that a converter reboot has ocured.

LED

The BSL-350 Converter has 10 LEDs (color lamp indicators) that indicates the status of the converter.

Name	Color	State	Description
PWR	Green	On	OK. Power is good.
		Toggles	Error. Power present but below minimum or over maximum input voltage. Check power supply.
FLT	Red	Off	OK. Indicates converter is operating normal and correctly.
		Toggle	Fault. Indicates a fault. See display on AutroSafe panel for details and fault codes.
		On	Error. Critical hardware or software error. Software has halted. Service or repair is required.
ST0	Yellow	Off	Error. Indicates the converter has not been connected to the Top-Level system since power on or reset/restart. Check the ASAP communication link or Top-Level system.
		On	OK. Indicates the Top-Level system is connected to the Converter. The converter assumes this after the first ASAP General Status Enquiry request message has been received.
		Toggle	Error. Indicates the connection link to the Top-Level system has been lost. Converter assume the ASAP communication be broken if no error-free General Status Enquiry requests messages have been received for 100 seconds. Check the ASAP communication link or Top-Level system.
TX0	Green	Flash	Converter is transmitting ASAP data.
RX0	Red	Flash	Converter is receiving ASAP data.
Tx1	Green	Flash	Converter is transmitting AutroCom data.
RX1	Red	Flash	Converter is receiving AutroCom data.
TX	Green	N/A	Not used.
RX	Red	N/A	Not used.
ST1	Yellow	Off	Error. Indicates AutroSafe panel is not logged in to the converter. Check the AutroCom Communication link or AutroSafe panel.
		On	OK. Indicates AutroSafe panel is logged in to the converter.
		Toggle	Error. Indicates AutroSafe panel is logged in, but no error-free AutroCom communication has been observed

Name	Color	State	Description
			for the last 100 seconds. Check the AutroCom Communication link or AutroSafe panel.

States description:

- Off
- On (When a LED is stable on)
- Toggle: LED blinks with 2 Hz frequency.
- Flash: A short flash to indicate that a data is being transmitted or received on the serial ports. Flash is of approximately 0,1 second duration.

Address switch

The two address switch wheels are used to set the ASAP address.

The ASAP address is a alphabetic letter code in range from A to Z. The address must match the address configured in the Top-Level System.

If several BSL-350 Converters are connected to the same ASAP Link using multi-drop fesature, each converter must have a unique address on the link.

The ASAP address code is set by the two address switch wheels in combination. The table below indicates valid combinations to set a given ASAP address:

ASAP Address	HI Switch	LO Switch
A	0	0
B	0	1
C	0	2
D	0	3
E	0	4
F	0	5
G	0	6
H	0	7
I	0	8
J	0	9
K	1	0
L	1	1
M	1	2
N	1	3
O	1	4
P	1	5
Q	1	6
R	1	7
S	1	8
T	1	9
U	1	0
V	2	1
W	2	2
X	2	3

Y	2	4
Z	2	5

After the address switch has been changed, the fault lamp will start to toggle and a fault message is shown on the AutroSafe panel's display. This is normal and its purpose is to indicate to the user that the system has been altered. The fault must be accepted on the AutroSafe panel in order to remove this fault.

If the Address switches are set to invalid combinations, the fault lamp will start toggling, and a fault message is shown on the AutroSafe display. The Address Switches must be set to a valid combinations and the fault must be accepted in the AutroSafe panel in order to remove this fault.

10.3.2 Maintenance

During normal operation, no maintenance of the BSL-350 are needed.

If the configuration for the AutroSafe panel is changed, the BSL-350 Converter's configuration must be updated accordingly. See chapiter 10.2 Configuration for details.

10.3.3 Fault diagnostic

10.3.3.1 Fault and error handling

The BSL-350 Converter indicates faults in four ways:

- FLT LED (fault indicator lamp) on front of Converter unit is blinking.
- Fault messages are displayed on AutroSafe panel
- Fault will be indicated to the Top-Level System in two ways:
    - If the converter is able to operate correctly, a fault message is sent on the ASAP Communication Link to the Top-Level System
    - If the converter is not able to operate correctly, the ASAP Communication Link will be disabled. The Top-Level System will detect this as communication has been lost.

10.3.3.2 Fault LED

If BSL-350 Converter unit has any faults, the Fault LED on the converter front panel will blink. As long as the fault is unaccepted, the LED will blink. The user must accept the fault on the AutroSafe panel in order to turn off the LED.

10.3.3.3 Fault messages on AutroSafe panel

Faults and warnings will be reported to AutroSafe and be displayed on the AutroSafe panel. Fault messages from the BSL-350 Converter have the following types and data:

In AutroSafe panel's display, this fault type will be indicated as "Communication – Protocol converter fault". Additional a series of data numbers will indicate the fault reason.

The table below can be used to identify the fault reason and recommended action to resolve toe fault:

Data #1	Data #2	Description	How to resolve	Disable ASAP Link *
1	2	BSL-350 Converter has been restarted by user pressing the reset button.	This message is a warning and can be accepted and ignored.	
1	7	BSL-350 Converter has started due to power-on, or restarted due to power break.	The BSL-350 Converter must always be powered when in use. Check power supply if a power-break was not expected.	
1	Any other numbers	BSL-350 Converter has been restarted due to software problem.	This fault and Data #2 value should be reported to Autronica Fire and Security.	
2	-	New configuration has been downloaded.	This is a warning message. If configuration is correct, this message can be accepted and ignored.	
3	-	BSL-350 Converter has detected an error in the configuration.	Correct the configuration and download it to the Converter.	X
4	-	Configuration has wrong time-stamp. The configuration contains a time-stamp. The time-stamp in AutroSafe configuration must match the ASAP Configuration.	This fault occur if configuration has been upgraded on AutroSafe, but not in the BSL-350 Converter. Download the correct configuration.	X
5	-	System has a detector or loop UnitID that does not exist in the configuration.	The configuration is wrong. Correct the configuration and download it.	
6	-	ASAP Link has been lost.	Check the ASAP Communication cable.	
7	-	ASAP Link timeout fault.	The ASAP time-out value set in the configuration is wrong. Correct the configuration.	
8	-	ASAP Address switch-wheel has been change by a user.	This is a warning, if the ASAP address is corrected; this message can be accepted and ignored.	
9	-	ASAP Address switch wheel on the BSL-350 Converter unit has been set to an invalid value.	Set the ASAP address to correct value.	**
10	-	AutroCom Link has been lost.	Check the AutroCom Link.	X

* The X indicates that the fault also will disable the ASAP Link and give fault message ASAP Link Lost (Data #1 set to 6).

** If the ASAP switch wheel is set to invalid combination, the BSL-350 Converter will not have an address, and will be unable to connect to Top-Level System. In this way the link will be lost causing ASAP Link Lost fault message to be sent.

10.3.3.4 Fault indication to Top-Level System

The following The BSL-350 Converter sendes the following fault messages to the Top-Level System:

- **Detector fault**
  If a detector fault occurs, the BSL-350 Converter will transmit ASAP Directive 12 with detector number and loop number for the detector affected.

- **Loop fault**
  If a loop fault occurs, the BSL-350 Converter will transmit ASAP Directive 13 with loop number for the loop affected.

- **External fault**
  For any other fault related to the AutroSafe system or the converter, ASAP Directive 18 is transmitted.

For any of the fault messages sent to the Top Level System, the AutroSafe panel's display will give more detailed information. If a fault occurs, the operator must check the AutroSafe panel.

10.3.3.5 Fault causing ASAP Link to be disabled

The following faults and errors will cause the ASAP Link to be disabled. When the ASAP Link is disabled, the BSL-350 Converter will not answer requests sent to it and it will appear as the ASAP Communication cable is broken.

- If configuration has wrong time-stamp.
- If AutroCom serial cable is broken/disconnected.
- If BSL-350 Converter unit has an internal hardware error.

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