FIRE AND SECURITY

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Release 3.4.1

Interfacing Third Party Modbus Compatible Equipment

AutroSafe Modbus Converter BSL-330

See Quick Reference Guide on the back page of the handbook.

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Table of Contents

1. Introduction

1.1 About the Handbook

This handbook provides all necessary information for the installation and commissioning of the *AutroSafe Modbus Converter BSL-330* (referred to as *BSL-330 Converter* throughout the handbook), and the interfacing of third party Modbus compatible equipment (PLC equipment).

1.2 The Reader

The handbook is intended to be used by trained service and technical personnel who are responsible for interfacing third party modbus compatible equipment used to the AutroSafe Interactive Fire Alarm System.

We assume that the reader has the following basic knowledge.

- AutroSafe functionality
- AutroSafe Configuration Data (output from the AutroSafe Configuration Tool, configuration files)

1.3 Terms and Abbreviations

The handbook deals with AutroSafe-related terms and abbreviations.

Throughout the handbook the term *third party Modbus compatible equipment* is used. This term is similar to *PLC equipment* (Programmable Logic Controllers) which is used in some tables.

For further information on definitions, refer to the System Specification for the AutroSafe Interactive Fire Alarm System.

2. About the Modbus Converter

2.1 Description

The *BSL-330 Converter* is an RS-232/422/485 interface module used to interface various third party Modbus Compatible equipment / PLC equipment (Programmable Logic Controllers) to the AutroSafe Interactive Fire Alarm System.

The module is both a physical and a logic protocol converter. At the physical connection level, it transforms an RS232 connection to an RS-422 (or RS485 or RS232) connection. These options matches most of the possible equipment to connect to. The interfaces are galvanically isolated giving improved reliability in noisy environments.

The module is connected to the AutroSafe via the AutroCom protocol. It communicates with both protocols by means of the conversion software.

A Master Modbus device polls a Modbus Slave in order to update information in a list of Registers. As the BSL-330 can be either Master or Slave, the transfer direction of data is thereby determined by the variant. A BSL-330 Slave will passively respond to a Modbus Master's request and transmit data to the Master (typically a PLC), while a Master BSL-330 will actively put data into the PLC (this must then be a Slave).

The BSL-330 Converter offers:

- Detector statuses of the AutroSafe to be made available to a Modbus PLC
- FPE (Fire Protection Equipment) status and control
- Basic commands to the AutroSafe from a Modbus PLC
- FAD (Fire Alarm Device) status

Following in the document, the terms are used:

- BSL-330, includes all variants of the product, unless explicitely mentioned.
- Modbus device
  The equipment that AutroSafe data is intended for, in the Modbus network. This is typically a PLC; but could be other products as well.

Modbus Converter BSL-330

2.2 Product Variants

There are 4 variants of the product:

- BSL-330/1 AutroSafe Modbus Converter Slave RS-422/485
- BSL-330/2 AutroSafe Modbus Converter Master RS-422/485
- BSL-330/3 AutroSafe Modbus Converter Slave RS-232
- BSL-330/4 AutroSafe Modbus Converter Master RS-232

2.3 AutroSafe Software Requirements

The use of *Modbus Converter* requires AutroSafe software version 3.2.0 or newer. For use with AutroSafe software version 3.3.0 and later, the full functionality of the BSL-330 is supported.

2.4 Backwards Compatibility

Version 3.3 of the Modbus Converter introduced new features and user selectable options. Previous revisions of the BSL-330 had just a subset of the possible features. With version 3.2.0 the configuration files for backwards compatibility must be used (contact the Support Centre for further information).

Used with AutroSafe version 3.2.0 only point and system status are available.

To ensure correct settings in the event of a replacement of these units, refer to chapter 13.3.3 and 13.3.4.

2.5 Version Compatibility matrix

From AutroSafe 3.4.1, there is a change to the AutroCom protocol that is not backwards compatible for FPE (Fire Protection Equipment, also called digital I/O). This may cause problems in some situations, where the PLC will not be able to present the state of inputs.

PLC designed for BSL-330 version 3.3 (existing installations)

AutroSafe version	BSL-330 version	Compatibility
3.3	3.3	OK
3.3	3.4 upgrade	OK
3.4 upgrade	3.3	Must upgrade BSL-330 to new version
3.4 upgrade	3.4 upgrade	Set BSL-330 Config option `Settings[1]; OldFPEs=T;`

PLC designed for BSL-330 version >= 3.4 (new installations)
In this case it only makes sense to use latest AutroSafe and BSL-330, both version >=3.4

2.6 Modbus Service CD

The *Modbus Service CD-ROM* (AS-MODBUSCD) includes the necessary documentation and programs / hyperlink to program:

Documentation in pdf-format

- the handbook AutroSafe Modbus BSL-330 - *Interfacing Third Party Modbus Compatible Equipment* plus (P-MODBUS/EE)
- the data sheet for the Modbus Converter BSL-330 (P-BSL330/CE)

Programs / tools

- AS-AUTROCOMTST, AutroCom Test v.3.3.1
- The KD485 Configuration Program for baud rate settings (KDCFG.EXE)
- Default Configuration files:
  - BSL-330 MasterConfig.txt
  - BSL-330 SlaveConfig.txt
- Files for backwards compatibility:
  - BSL-330 MasterBWCConfig.txt
  - BSL-330 SlaveBWCConfig.txt
- Hyperlink to the Modbus simulator (Mdbus.exe program) found on www.calta.com (Index.html)

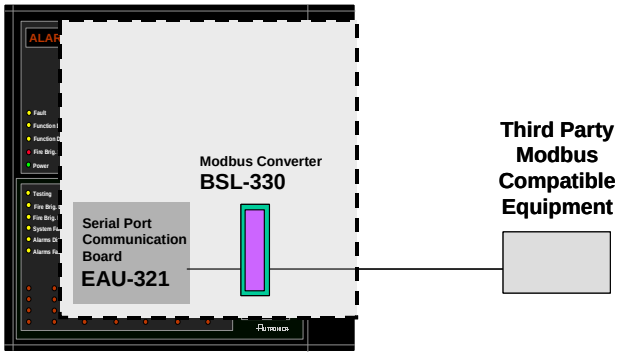
The Mdbus.exe program is a third party test tool which must be purchased separately (from www.calta.com).

The necessary **cables** are not included (must be ordered separately).

- *Communication Cable XJA-036* is used between the computer and Port 1 on the BSL-330 Converter.
- *Communication Cable XJA-037* is used between the computer and Port 2 on the BSL-330 Converter.
- *Communication Cable XBA-055* is used between the Serial Communication Board EAU-321 and Port 1 on the BSL-330 Converter.

The Serial Port Communication Board EAU-321 must be ordered separately.

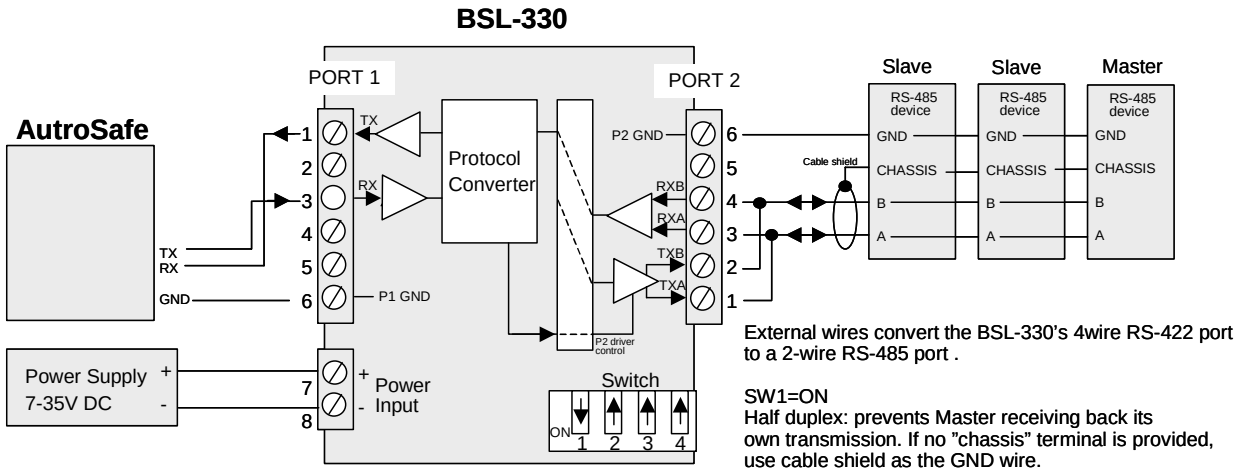
2.7 Overview



AutroSafe – BS-320 / BC-320 panels

2.8 Typical Application

The drawing below shows a typical application of the BSL-330 Converter.



2.9 Reference Documentation

In addition to this handbook, Autronica Fire and Security offers additional documentation related to the *Modbus Converter BSL-330*:

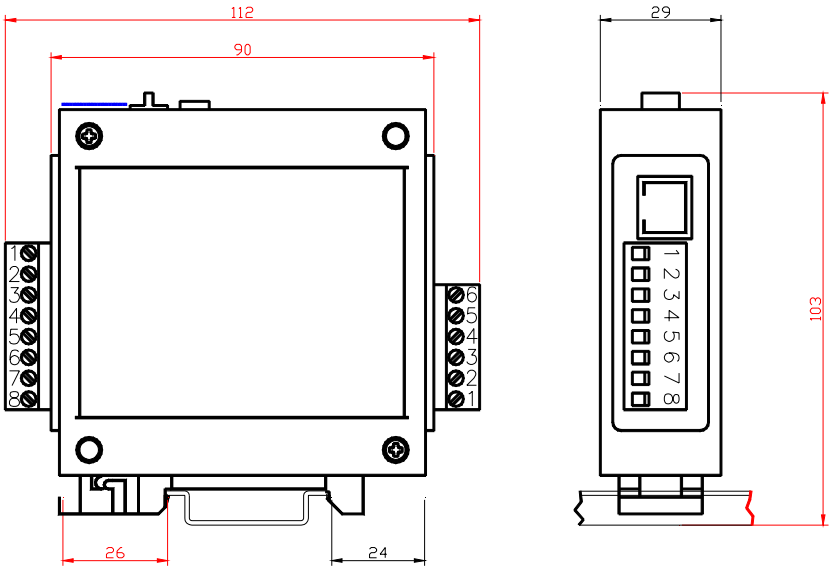
- AutroCom Test Program, SW tool BSL-330 AS-AUTROCOMTST
- Modbus specification ref MODBUS Protocol Reference Guide Rev J, MODICON, June 1996, *doc id PI_MBUS_300*

2.10 Specifications BSL-330 Converter

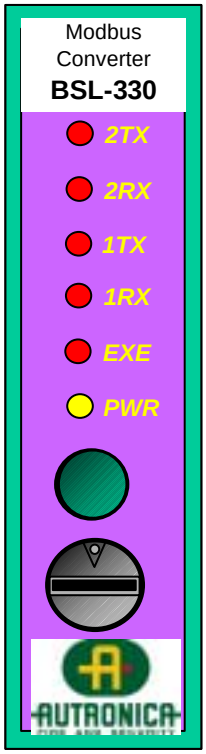
Max no of AutroSafe detectors	4096
Max no of FPEs	512
Ports	Two asynchronous ports, TX & RX signals only. Each port isolated from each other and from power.
Modbus interface	Port 2. Modbus RTU protocol Baud rate selectable 4800/9600/19200/38400 baud Odd/Even/No parity, 1 or 2 stop bits. 8 databit.
Interface Options	Port 1 is RS232 (AutroSafe communication); Port 2 is RS422/485 or RS232 (Modbus communication).
RS-232	Receiver threshold + 1.5V typ. Receiver Rin 5kΩ typ. TX o/p ±8V typ (3k load).
RS-422/485	Receiver threshold 200mV typ (differential). Receiver Rin 12kΩ min. TX o/p 0 to + 5V (no DC load); + 2 to + 3V (120Ω ohm load).
Power supply	+ 7V to + 35V DC. + 12V DC Input power approx. constant at 1-2 watts (startup current 300-600mA) depending on model. At startup, the supply voltage must reach 7V in <1 sec.
Isolation	64V PK, tested at >1000V AC RMS, 1 second.
Environmental	Operating temperature 0 to +50C. Storage temperature -25C to + 70C. Relative humidity (operating and storage) 0 to 90%, non-condensing.
Ventilation	Rail-mounted KD485 must have a 50mm gap above and below.
EMC compliance	Emissions EN50081-2 (94), immunity EN50082-2 (95).
Dimensions	29mm (W) x 112mm (H) x 103mm (L) approximately in rail-mounted position, including screw terminals.

2.11 Dimensions

The drawing below shows the dimensions of the BSL-330 Converter.



2.12 Indicators and Buttons

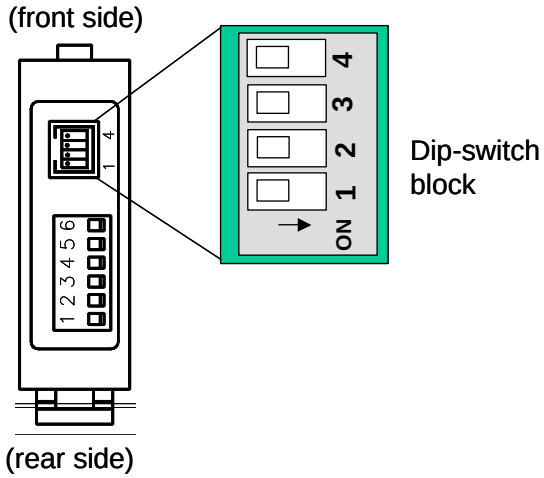


The BSL-330 Converter has the following indicators and buttons:

- 2TX: Red LED - Send (TX) Port 2 (to external PLC equipment).
  Blinking light (several per second) indicates that signals are being sent.
- 2RX: Red LED - Receive (RX) Port 2 (to external PLC equipment).
  Blinking light (similar to 2TX) indicates that signals are being received.
- 1TX: Red LED - Send (TX) Port 1 (to EAU-321 – AutroSafe).
  Blinking light (2 seconds intervals) indicates that signals are being sent.
- 1RX: Red LED - Receive (RX) Port 1 (to EAU-321 – AutroSafe).
  Blinking light (2 seconds intervals) indicates that signals are being received.
- EXE: Red LED – Operation: Indication of traffic.
  - Switched on when an AutroSafe event occurs, switched off when sent to Modbus.
  - Normal operation: EXE lights steady while a message is sent to the PLC equipment. Blinking light (0.5 second intervals) when green button has been pressed.
- PWR: Yellow LED – Steady light indicates Power ON.
- Green Executive Mode button. Used to enter Executive Mode (when setting parameters).
- Grey rotary switch (default factory settings - 0).

2.13 Dip-switches – Overview

Top View of BSL-330 Converter



3. Installation and Cable Connections Overview

3.1 Installing the Programs on the Computer

The Modbus Protocol Interface CD (AS-MODBUSCD) includes

- The KD485 Configuration Program
- AutroCom Test Program

Make sure that these programs are installed on your service computer.

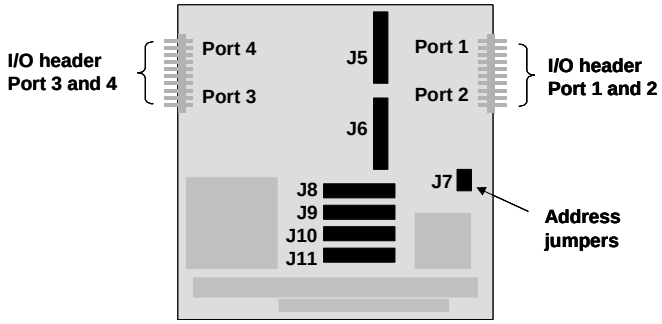
- Insert the CD-ROM and install the programs one by one.

Note:
The use of one computer with one serial port is described in this handbook. Note that it is possible to use several computers at the same time (if several serial ports / computers are available).

3.2 Installing the Serial Port Communication Board EAU-321

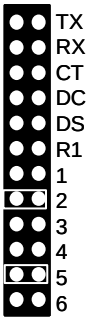
3.2.1 Jumper Settings

The table below gives an overview of the jumper settings for the Serial Port Communication Board EAU-321.

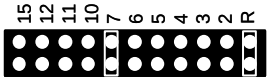


Serial Port Communication Board EAU-321

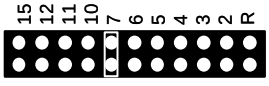
Jumpers J5 and J6:
J5 and J6 must be set to interrupt 2 and 5.



Jumpers J8 (interrupt)
J8 must be set to interrupt 7 and R.



Jumpers J9, J10 and J11 (interrupt)
All ports must be set to interrupt 7.



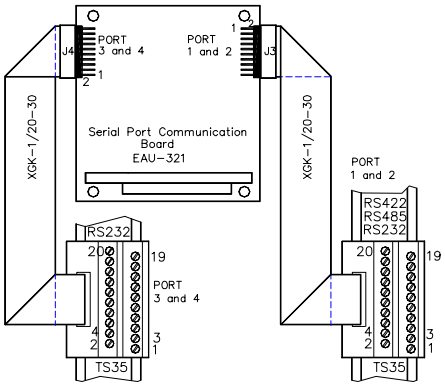
Jumper J7 (board address)
Jumper in position A and B must be set to In.
This setting applies to all communication boards.
Gives address 100h.

3.2.2 Connections on Terminal Blocks X1 and X2 *(if used)*

Alternatively, *Communication Cable XBA-055* can be used. (Refer to chapter 3.4.1).

X1

NC	20	19	GND	
RI 2	18	17	DTR 2	
CTS 2	16	15	TXD 2	Port 2
RTS 2	14	13	RXD 2	
DSR 2	12	11	DCD 2	
NC	10	9	GND	
RI 1	8	7	DTR 1	
CTS 1	6	5	TXD 1	Port 1
RTS 1	4	3	RXD 1	
DSR 1	2	1	DCD 1	



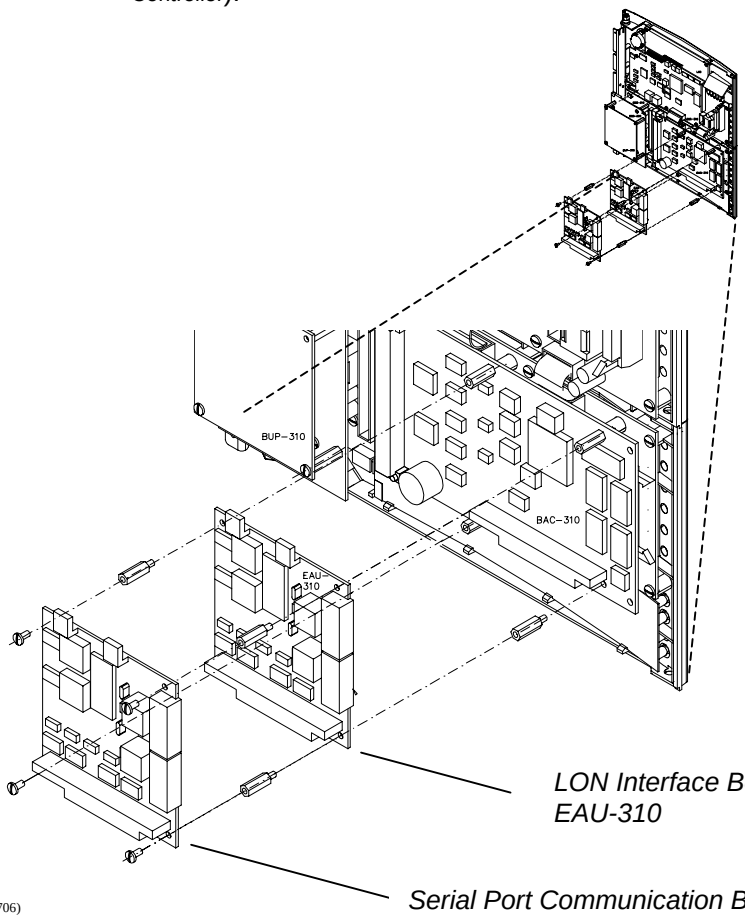
Terminal Block X1 *Terminal Block X2*

3.2.3 Mounting the Board

The Serial Port Communication Board, EAU-321 is to be mounted onto the LON Interface Board EAU-310* (if the system is a distributed system) or directly onto the Processor Board EAC-300 (if the system is a standalone system).

The board can be mounted inside any BS-310/320 panel or BC-320 Controller. However in a distributed system the board should preferably be mounted inside the Booting Panel.

* The illustration below shows how to mount the EAU-321 board onto the LON Interface Board, EAU-310 inside a *system unit* (Fire Alarm Control Panel or Controller).



LON Interface Board, EAU-310

Serial Port Communication Board, EAU-321

(Reference: Dwg. no. UD-706)

3.3 Installing the BSL-330 Converter

3.3.1 General

The third party Modbus compatible equipment / PLC equipment should be placed in the same room. Normally, RS232 distance limitations apply – i.e. maximum 15 metres. If longer distances are required shielded cable is recommended. (Port 2 is isolated, i.e. there are no problems with grounding).

3.3.2 Mounting onto the Standard Mounting Rail Inside the Cabinet

The module is connected to the AutroSafe via one RS232 port on the Serial Port Communication Board, EAU-321 (EAU-321 supports up to 2 AutroCom links).

The BSL-330 Converter can be mounted and plugged onto the standard mounting rail inside the Fire Alarm Control Panel / Controller. The module is powered from AutroSafe's 24V DC power.

If the module is to be mounted onto the standard mounting rail inside the cabinet, the dip-switch on the module must be pointing to the left when the module is to be inserted.

- Snap the left side of the fastener onto the mounting rail (1), then press the module slightly inwards (2) until the right side fastens.

3.3.3 Mounting on an External DIN-rail

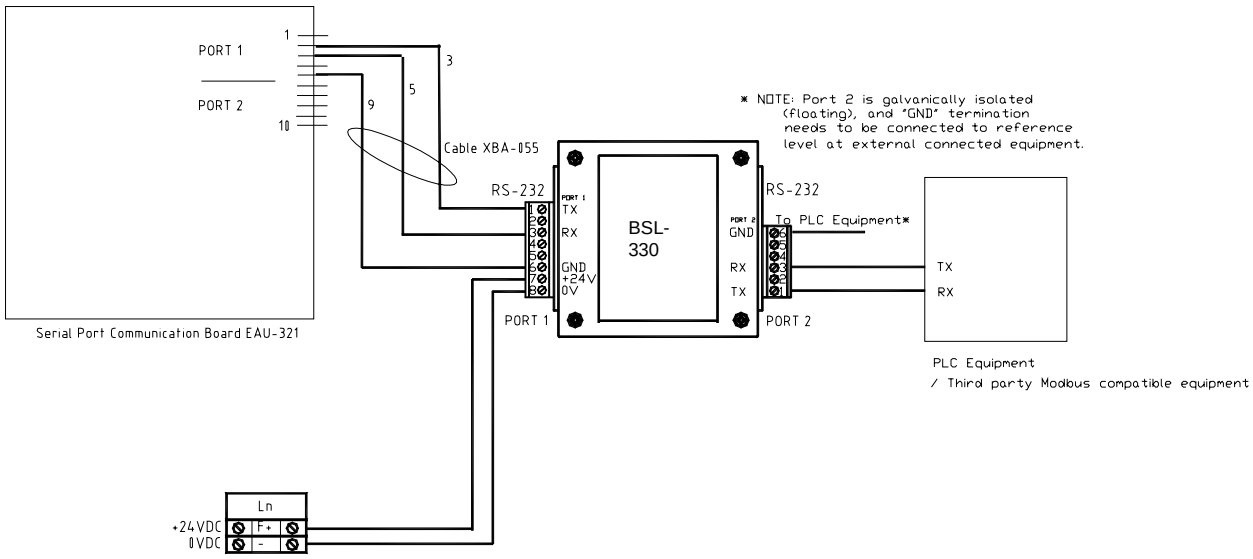
Alternatively, the module can also be placed on an external DIN-rail and powered with an external 24V DC.

3.4 Cable Connections Overview

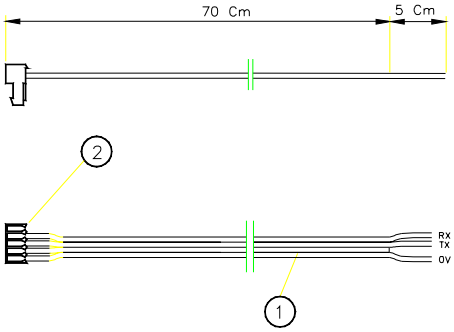
3.4.1 Connection between EAU-321 and Port 1 on the BSL-330 Converter

Port 1 on the BSL-330 Converter is used for the cable connection from AutroSafe, while *Port 2* is used for the connection to the third party Modbus compatible equipment / PLC equipment. There are two alternative ways of connecting the RS232 Serial Interface Cables.

Alternative A: Connection to EAU-321 directly
If there is no free space inside the AutroSafe cabinet for the terminal block, connect directly to the flat cable connector on EAU-321 (using the cable XBA-055). The used pins are in the top row.

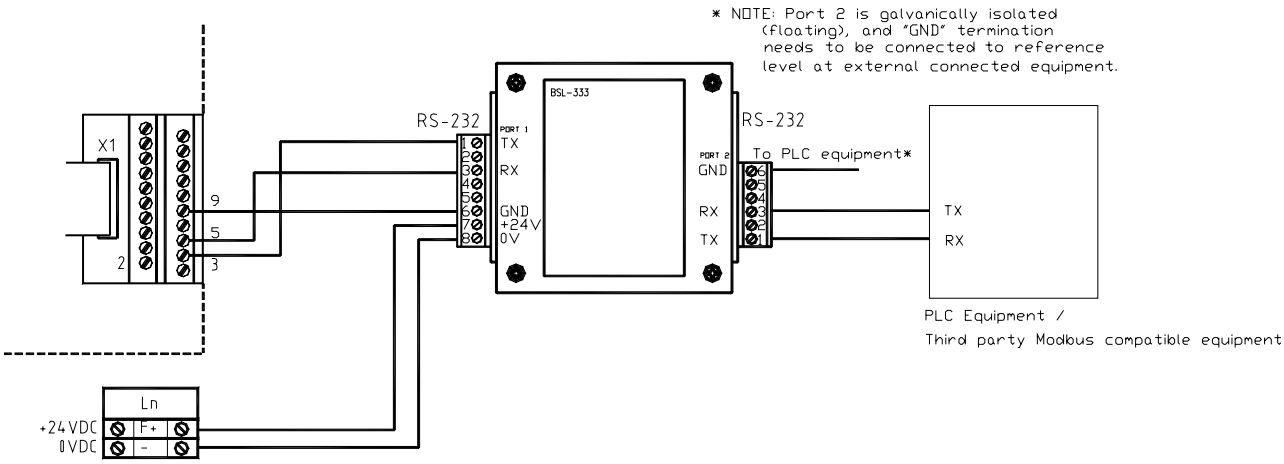


Communication Cable XBA-055 is used between the Serial Communication Board EAU-321 and Port 1 on the BSL-330 Converter.



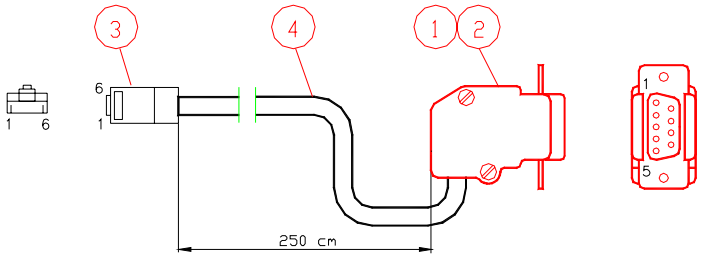
Alternative B:
Connection by means of the screw connector (X1 and X2)
This alternative may be suitable in larger systems where several ports are to be used. Note that the screw connector is not standard.

- Connect the cable from the Serial Port Interface Board EAU-321 (inside the AutroSafe BS-320) to the connector (Port 1) on the BSL-330 Converter.
- Connect the cable from the connector (Port 2) on the BSL-330 Converter to the third party Modbus compatible equipment / PLC equipment (the connector for connection to the third party Modbus compatible equipment / PLC equipment may vary depending on the type of equipment).



3.4.2 Connection between the computer (configuration) and Port 1 on the BSL-330 Converter

Communication Cable XJA-036 (test purposes)
is used between the computer and Port 1 on the BSL-330 Converter when AutroCom Test Program is to be used..

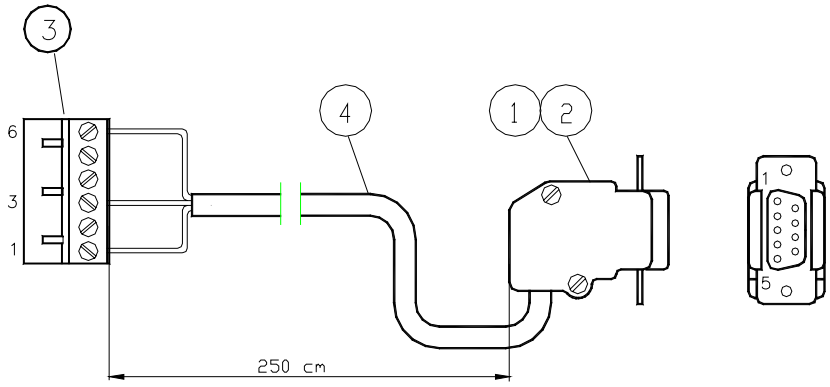


Kablingstabell

Signal	9-pin Desub Connector to Computer (1)	Connector BSL-330 to Port 1
RX	2	4
TX	3	5
GND	5	3

3.4.3 Connection between the computer (test) and Port 2 on the BSL-330 Converter

Communication Cable XJA-037 (test purposes)
is used between the computer and Port 2 on the BSL-330 Converter when PagerTest Program is to be used.

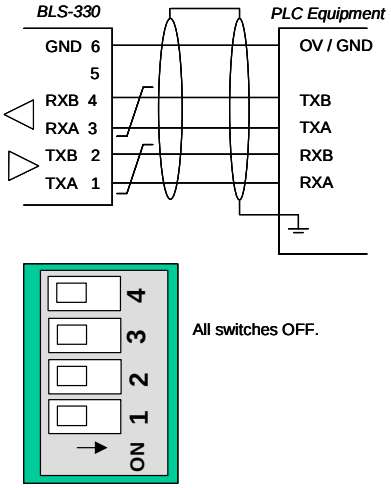


Kablingstabell

Signal	9-pin Desub Connector to Computer (1)	Connector computer to BSL-330, Port 2 (3)
RX	2	1
TX	3	3
GND	5	6

3.4.4 Connection to Third Party Modbus Compatible Equipment

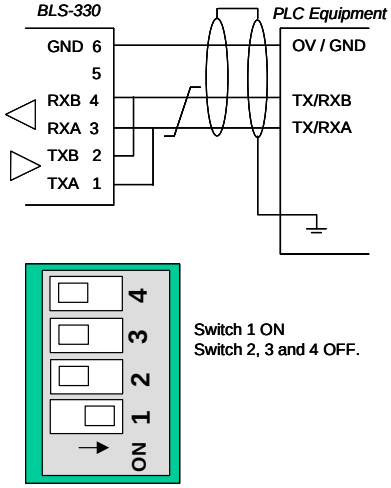
RS422



All switches OFF.

Note: The reference (GND, 6) must be connected either to the PLC's serial port reference of to the cable shield which then must be connected to the PLC's reference or chassis.

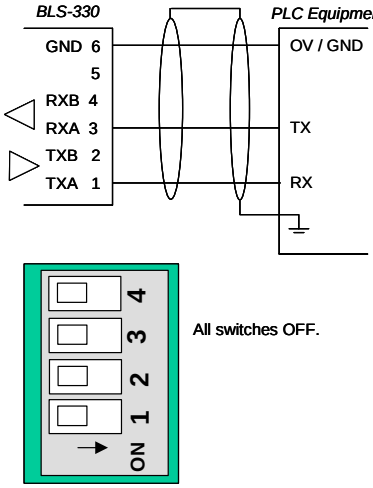
RS485



Switch 1 ON
Switch 2, 3 and 4 OFF.

Note: The reference (GND, 6) must be connected either to the PLC's serial port reference of to the cable shield which then must be connected to the PLC's reference or chassis.

RS232



All switches OFF.

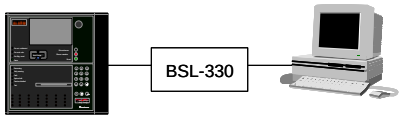
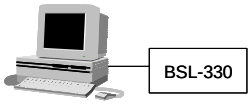
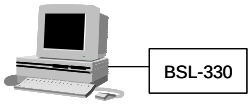
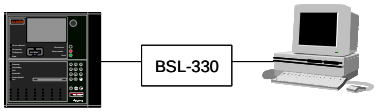
Note: The reference (GND, 6) of RS232 at BLS-330 must be connected to the PLC's RS232 port reference.

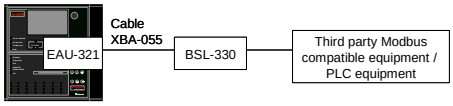
Don't know which wire is A and B? When idle, B is more positive than A.

4. Quick Reference Guide

4.1 Quick Reference Guide – all necessary steps

This chapter outlines all the necessary steps to successfully interface AutroSafe to third party Modbus compatible equipment / PLC equipment.

	Chapter / procedure		Remarks
15	**Verifying the communication between AutroSafe and the BSL-330 Converter using the default configuration of the BSL-330 Converter** *(page 96)*		Before customizing the configuration of the BSL-330 Converter, it is possible to verify that the cabling and communication between AutroSafe and the BSL-330 Converter is successful and that BSL-330 operates correctly with AutroSafe. This verification is based on the default configuration of the BSL-330 Converter (Master / Slave).
5	**Planning related to the third party Modbus compatible equipment / PLC equipment that is to be used** *(page 22)*		Information about the third party Modbus compatible equipment you must be aware of before commissioning (basic information and special issues).
6	**Getting familiar with the BSL-330 Configuration** *(page 30)*		Information about the BSL-330 Configuration.
7	**Configuring the AutroSafe system** *(page 39)*		The procedure deals with the configuration of the AutroSafe Interactive Fire Alarm System. The AutroSafe Configuration Tool is used for this purpose.
8	**Preparing the BSL-330 Converter** *(page 46)*		The BSL-330 is delivered with a standard setup (parameter settings) from the factory. This chapter provides information on the necessary preparations of the module. The KD-485 Configuration Program is used for this purpose.
9	**Configuring the customised setup of the BSL-330 Converter** *(page 51)*		The procedure deals with the setup related to the third party Modbus compatible equipment / PLC equipment that is to be used. The AutroCom Test Program is used for this purpose.
10	**Verifying the customised setup of the BSL-330 Converter** *(page 58)*		The procedure verifies that the customised setup is successful.

	Chapter / procedure		Remarks
11	**Verifying the complete system setup** *(page 60)*		The procedure provides information on how to verify the complete system setup. The AutroSafe system is used to activate various events, i.e. fire alarms, prealarms, fault messages, etc.

4.2 Quick Reference Guide for Configuring the PLC

1) Modbus Function Codes

- Slave, chapter 15.4
- Master, chapter 15.5

2) Register setup, chapter 14.4

3) Configuration

- Parameter definitions, chapter 13
- Download, chapter 9.3

4) Connections to the Modbus interface, chapter 3.4.4

5. What you need to know about the Modbus Compatible Equipment

5.1 Basic Information

To avoid possible problems caused by wrong settings or preparations on the third party Modbus compatible equipment / PLC equipment, it is important to know the following basic information about the third party Modbus compatible equipment / PLC equipment that is to be used.

5.1.1 Hardware

RS232 Hardware
What type of port is used: D-Sub, 9 or 25 pins, screw terminals, RJ-45? (You may have to make test cables from your PC to this plug). Does the serial interface have LEDs or similar that can be used to monitor operation?

RS232 line settings
Autronica Fire and Security recommends 9600 baud, 8 bits, No parity, 1 stop bit.

5.2 MODBUS for AutroSafe

Modbus is a data protocol used to communicate between Process Logic Controllers (PLCs) and I/O equipment.

5.2.1 Organization of I/O

Modbus organizes hardware in a simple way. All I/O looks like **tables** of either single-bit I/O, or 16-bit numbers (integers). The contents of these tables are transported periodically between the I/O system(s) and the PLC. The receiving end must detect changes, and act upon them.

5.2.1.1 Tables

Primary tables	Object type	Type of access	Comments
Discrete Input	1 bit	Read-Only	Data can be provided by an I/O system.
Coils (outputs)	1 bit	Read-Write	Data can be alterable by a program of the PLC.
Input Registers	16-bit word	Read-Only	Data can be provided by an I/O system
Holding Registers	16-bit word	Read-Write	Data can be alterable by an application program.

5.2.1.2 Relations between tables

The distinctions between inputs and outputs, and between bit-addressable and word-addressable data items, do not imply any application behavior. It is perfectly acceptable, and very common, to regard all four tables as overlaying one another, if this is the most natural interpretation on the target machine in question.

For each of the primary tables, the protocol allows individual selection of 65536 data items, and the operations of read or write of those items are designed to span multiple consecutive data items up to a data size limit which is dependent on the transaction function code.

The data handled via MODBUS (bits, registers) must be located in device application memory. But physical address in memory should not be confused with data reference. The only requirement is to link data reference with physical address.
MODBUS logical reference numbers, which are used in **MODBUS protocol messages**, are unsigned integer indices starting at zero.

5.2.1.3 PLC view of the tables

Data references used in the **PLC tools** are reserved ranges of values, and each range starts at one. See chapter 13.

Modbus Name	Data Size		Register Addresses
Coil	1 bit		00001-09999
Input	1 bit	Read-Only	10001-19999
Input Register	16 bit	Read-Only	30001-39999
Holding Register	16 bit		40001-49999

The PLC tools are configured using these reference numbers in a uniform way. The low level Modbus software will then use the correct Modbus data protocol message to access the different tables, see chapter 15.4 and 15.5.

5.2.1.4 Modbus roles

A Modbus I/O system is organized with one **Master** and one or more **Slaves**. The Master reads and/or writes the I/O tables of each Slave periodically.

The BSL-330 is offered in two variants, Master and Slave:

- There is no functional difference; just two "roles" regarding which box is taking initiative to communication.
- There is a difference in register types, due to the fact that input registers are read-only:
  The Slave uses Input registers for detector statuses, while the Master uses Holding registers.

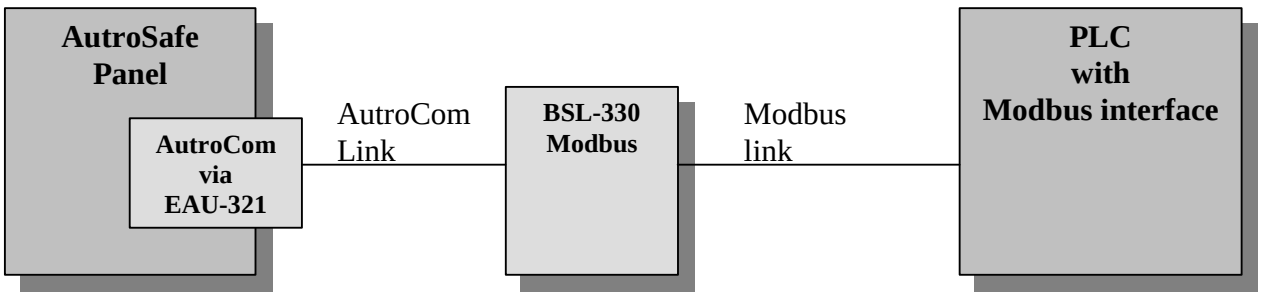
5.2.1.5 References

Modbus Application Protocol v1.pdf - "userfriendly", general even if TCP/IP oriented.
MODBUS Protocol Reference Guide Rev J, MODICON, June 1996, *doc id PI_MBUS_300*
Both can be found on www.modbus.org
Note that you must search for PI MBUS 300 to find the register specification.

5.3 AutroSafe Register Models

5.3.1 Physical Overview

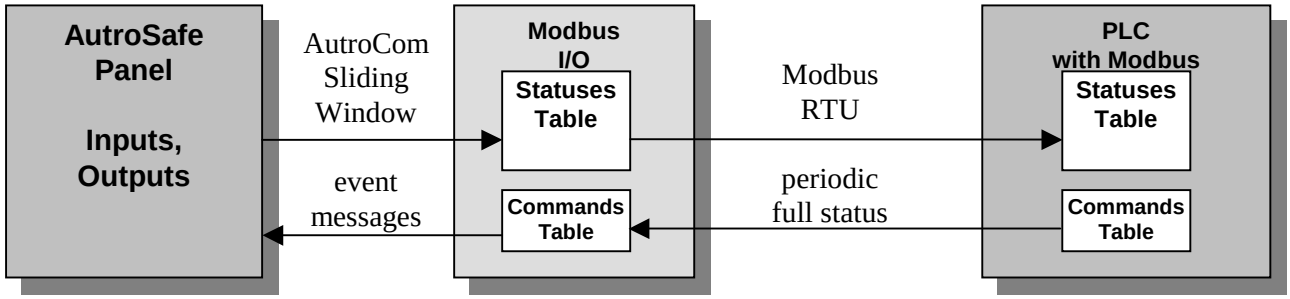
The Modbus interface for AutroSafe is implemented as a separate microprocessor, connected to AutroSafe via the AutroCom data protocol on RS232, and a PLC system on RS232 or RS485



The BSL-330 box is mounted inside the AutroSafe cabinet, and is powered from AutroSafe's 24V DC power.
The AutroSafe panel must have one port of an EAU-321 serial board available.

5.3.2 Modbus Logical Overview

The most common inputs in a fire system are **Detectors**, but other **Input statuses** are available via Modbus also. The general term **Statuses** is used in the following descriptions.
The PLC can control some aspects of the AutroSafe I/O via **Commands.**

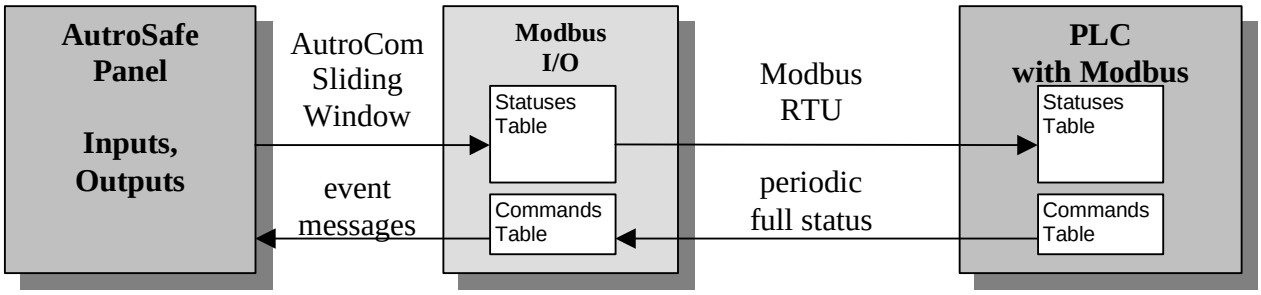


Usually the I/O is inside the **Slave**, with I/O accessible in a uniform way as **Tables**. The BSL-330's tables are regular RAM data structures. The Tables becomes Modbus "**Holding Registers**" and "**Input Registers**" at the moment when the information is transferred over the Modbus RTU bus – different message types are used for the different table types.

A Master's way of organizing information is not defined in the Modbus standard, but in the BSL-330 software we have an identical Table structure also in the **Master** variant. This makes the AutroCom handling software identical in both BSL-330 Master and Slave, and the only difference is the Modbus transport part.

5.3.3 BSL-330/1 Modbus Slave

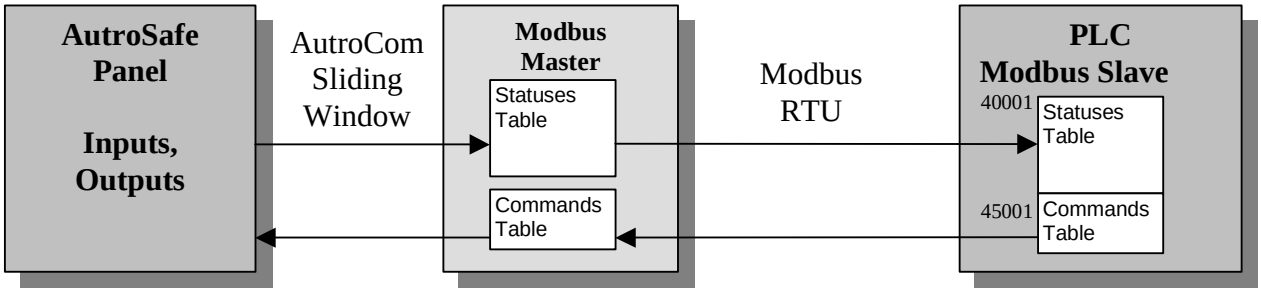
In this case the "Statuses Table" is implemented with Modbus ***Input*** Registers, while the "Commands" are Modbus Holding Registers. The Command register is actually read/write.
The general situation is simple also, as the Slave worries only about itself, and will reply to messages from the Master whenever they come.



5.3.4 BSL-330/2 Modbus Master (single)

In this case the "Statuses Table" is implemented with Modbus ***Holding*** Registers, and the "Commands" are Modbus Holding Registers also, in a separate address range.

The general situation is more complex. The Master must send AutroSafe events to the Slave PLC when they occur (updates single table lines), while maintaining a periodic poll of the Command registers. Communication problems on either side of the BSL-330 must cause a full update of the Slave (whole Table transferred quickly).

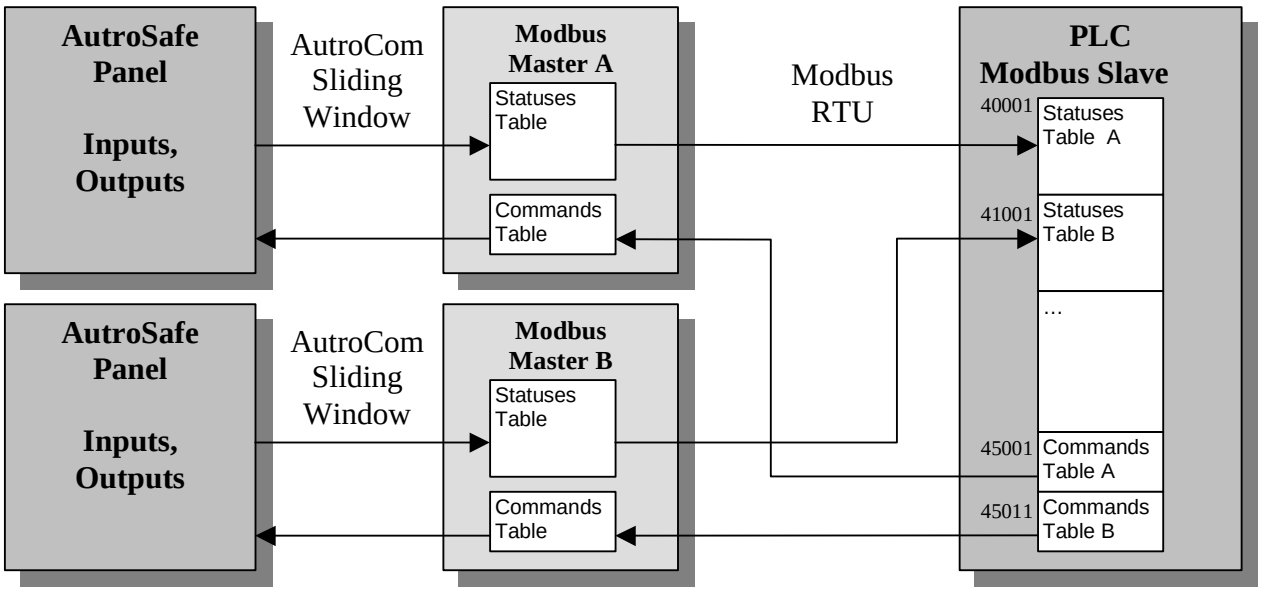


As both Tables are Holding Registers, it's necessary to assign them to **different address ranges** in the Slave.

5.3.5 Modbus Master (multiple)

Holding Registers are used for all tables, like above. The Master controls communication, like above.

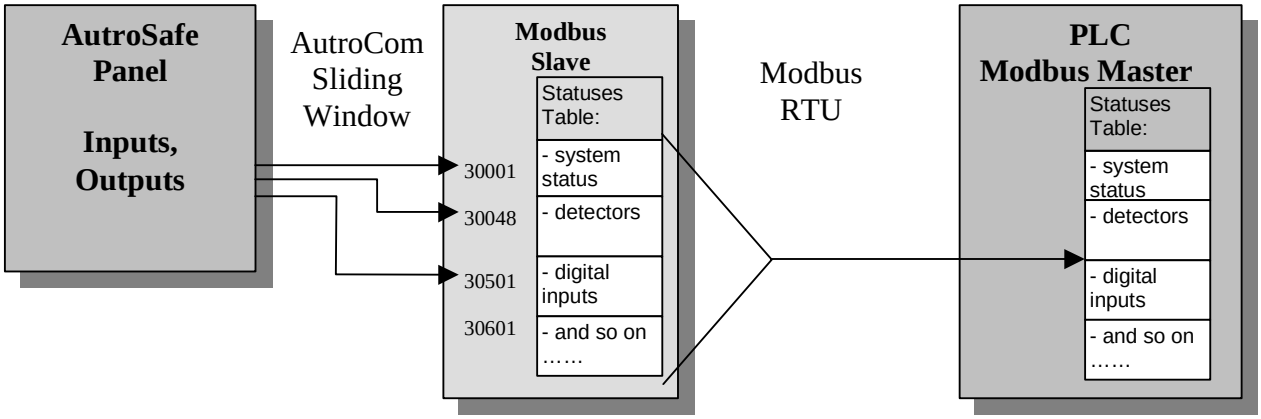
The PLC Slave has several Modbus interfaces, so it can be fed with data from several Masters at the same time. This can be used with several stand-alone AutroSafe systems.



The PLC's "grand view" of the world will have all status (read-only) registers in one area, and all Command (write-only) registers in another. This is obtained by using the same address mechanism as described for Master (single) (the address values shown in the drawing are just examples demonstrating the principle).

5.3.6 Register offset overview

The large Status Table can be filled in with status from several kinds of AutroSafe loop units, each with hardware numbered from 1 and up. Each "**sub-table**" is assigned a register start address (see an example in the drawing of the Modbus Slave below)



The size of each type Status info is configurable, e.g. 1000 detectors and 200 digital inputs.

6. About the BSL-330-Configuration

6.1 Introduction

The main configuration allows each installation to determine the behaviour regarding:

- Number of units (decrease to improve response time)
- Polling of cycle period

The configuration is written in a symbolic, software version independent, format. The configuration is handled by the AutroCom Test Program. Configuration data is sent to the BSL-330 Converter as one AutroCom message per Config text line.

This chapter gives some explanation, and also the relation between the **Statuses** coming from AutroSafe, and the various **Commands** that can be sent to AutroSafe.

6.2 Fire detection

A Fire Alarm system has a number of automatic and manual devices that detects fire (or gas leaks). Such a device is called a **point**. Points have several **statuses** that change *independently* of each other.

6.2.1 Point status: Fire Alarm

A fire (or gas) detector reports up to 4 states:

- Quiescent (no fire or gas)
- Pre-alarm (low gas)
- Alarm (high gas)
- Unknown(disabled, see below)

The entries are sorted on ascending priority, except for “unknown” which is just that.

An **alarm** is acknowledged by a RESET command, and will then go to state Quiescent. (If the **alarm** condition is still present, the point will enter **alarm** state again within a short time).

6.2.2 Point Status: Fault

A point can **fail** different ways, from loss of communication to internal self-test problems. Some of these problems will prevent the point from generating alarms, but not all.
A **Fault** is acknowledged by a RESET command. If the problem was corrected before the RESET the **Fault** status will change to OK, else the **Fault** will persist.

6.2.3 Point status: Disablement

A point has an **arm** status, which is **Enabled** or **Disabled.** A **Disabled** point will generate no events, that is, no alarms or faults.
Disabling is used during a fire to avoid repeated alarms and/or faults from a point in the fire area, and also during service to avoid fault messages.

A point can be **Disabled**/**Enabled** either from the AutroSafe panel, or the Modbus link. A RESET command has no effect on arm state. Change in arm state causes change in the other states simultaneously:

- To **Disabled**:
  The Alarm status changes to Unknown, while the Fault state changes to Disabled.
- To **Enabled**:
  The Alarm and Fault states changes to their current values. (They may have changed during the period of disablement)

Note: **Disablement** takes place inside the detector point itself. If a point is faulty due to loss of communication, the **Disable** command will not take effect (returns to **Enabled** state after a few seconds).

If a Loop Driver (BSD-3xx unit) is Disabled there will be no Disablement status in the Modbus registers of the detectors and I/O units on that loop.

A Loop Driver can be disabled by a service command on the AutroSafe panel, or during AutroSafe INIT if there is a big problem with the loop. If it is important for the PLC to show correct Disablement status in all situations, the PLC must monitor the LoopDrivers, and when their status change, update status of all related detectors and I/O units inside the PLC. To monitor Loop Driver statuses (disablement, fault) it is neccessary to add a line to the BSL-330's Config "Statuses[]" table, with "Type=DL;

6.2.4 Point status: Inhibit

Inhibit is an operation that block's AutroSafe's cause/effect logic. The **Inhibited** point reports events as usual to the AutroSafe panel display, but no Fire Alarm Devices (FAD=bells,sirens) are activated, and no Fire Protection Equipment (FPE=outputs) is affected.
Inhibit is used in situations where a fire alarm (gas alarm) is expected to be triggered by other operations in the area, and also during service when testing points.

A point can be **Inhibited** either from the AutroSafe panel, or the Modbus link. A RESET command has no effect on the inhibit state.

6.3 Digital I/O

6.3.1 Fire Protection Equipment (FPE)

FPEs are units with digital outputs (relays) and digital inputs (position monitoring, fault reporting). FPEs are normally configured in AutroSafe to be activated by various fire detection conditions, but can also be used completely independent by AutroSafe. In the latter case an external computer (the PLC) can both activate outputs, and monitor inputs.

Be aware that an activated FPE has certain functional requirements regarding change of the monitoring input. If e.g. a motor is started, there must be a feedback signal verifying the operation of the motor within a time limit, else a fault is reported. But as long as the unit is not activated, inputs are just reported whenever a change occurs. There are (configurable) response times for the input signals, which can be rather long, especially in the activate state (from 5 to 120 seconds). FPEs are located on detector loops or on BSB-310/BSJ-310 modules, and are not allowed to send messages frequently.

6.3.2 Fire Alarm Devices (FAD)

FADs are bells and sirens, for example, BBR-200 or bell output on the BSB-310 module.

FADs can only be controlled by AutroSafe, so a PLC can only monitor the state of a FAD. FAD states can be one of several “ringing patterns”, which describe the seriousness of the situation. In BSL-330, FAD state is simplified to “ON” or “OFF”.

6.3.3 FPE and FAD status:

“**Activation State**” is AutroSafe’s internal state for an output. Either ON or OFF.

BSL-330 version 3.3:
“**Operation State**” is the real state of the hardware, read back from the unit’s input(s). Normally ON or OFF, but there may be a fault indication related to problems during INIT of the unit. A Door Unit BN-320/4 can also have a state “Door not closed” which is indicated in this way (along with regular Fault status ON). See chapter 14.5 for details.
BSL-330 version >= 3.4:
”**Operation state**” is the loop unit’s state for an output (the relay drive). It has accepted a command from AutroSafe to set the output.

BSL-330 version >= 3.4:
”**Equipment state**” is the real state of the hardware, read back from the loop unit’s input(s). The equipment state depends on the type of FPE. See chapter 14.5 for details.

6.4 Commands to AutroSafe

6.4.1 System related commands

A PLC can send commands to AutroSafe that operates on the Operation Zone of the AutroCom link. This OZ is normally AutroSafe's top OZ, that is, these commands affects the whole system.

6.4.1.1 Silence

The Silence operation affects Fire Alarm Devices (FADs), that is bells and sirens. FADs are activated by AutroSafe's cause/action logic, and de-activated by Silence. In principle FADs are activated when the first detector reports a fire, and after a silence command, when a new detector reports fire (The FAD/silence behavior is very configurable, including delays).

Silence is used for two purposes:

- Very early in a fire situation, actually before any FAD/FPE is activated. A time delay runs, and during this period the system operator can investigate the detector point's neighborhood. If it's a real fire situation, the FADs/FPEs will be activated after the delay (a few minutes).
- Late in a fire situation when the evacuation of the building/area is under control.

6.4.1.2 Reset

The Reset operation affects all devices in AutroSafe. Detectors will return to Quiescent, and FADs/FPEs will de-activate.
Reset is normally used late in a fire situation.

The Reset operation can only be executed after a Silence operation. Systems controlled by PLCs often use only the detector part of AutroSafe, and then the operator's "reset button" should send Silence followed by Reset as a single operation.
Note: The BSL-330 will do an automatic "Update Status" when AutroSafe has finished processing Reset. This means that a PLC operator can use the Reset button to refresh the AutroSafe status at the PLC.

6.4.1.3 Initialize

The **Init** operation involves initialization of AutroSafe's hardware, including the detector loops. Init will remove Disablement and Inhibit settings, and Fault statuses (if unit has been repaired). Init is a lengthy operation, worst-case lasting some 10 minutes. During this period large parts of the fire detection system, and the FADs/FPEs are inoperative.

The **Init** command is available to a PLC via Modbus. It must be used with care, and should be hidden on some "maintenance page" in the operator's use interface. **Init** should be used only in situations where e.g. maintenance has caused a large part of the system to be out of order (in Fault), and then as a cleanup-operation if the system seems to have problems recovering automatically. (A service man can always do Init from the AutroSafe panel itself!).

6.4.2 Unit related commands

A PLC can send commands to AutroSafe that affects single loop Units.

- Enable and Disable a Point or a FPE
- Inhibit and Un-inhibit a Point
- Activate and De-Activate a FPE

These operations have been described in previous paragraphs.

6.5 Traffic considerations

A fire develops slowly in most cases, with seconds passing between each detector reporting fire.
There are some situations that causes heavy traffic:

- Loss of a whole detector loop (cables destroyed in fire, or service)
  Causes **Fault** status on more than 100 points in a few seconds.
- Disablement of a loop during fire or service (from AutroSafe panel)
  Causes **Disablement** status for more than 100 points, plus **Alarm** and **Fault** statuses for all non-quiescent points.

The BSL-330 Master version continously transmits the whole range of registers to the Slave in blocks of 50 registers. The sequence is:

- Read the Command word (3 registers) from the Slave.
- Write / Send the Watchdog register
- Write / Send a block of 50 registers.
- Send one register if an event is received from AutroSafe

If events are reported from AutroSafe, these are queued in BSL-330 and transmitted (one event only) between the blocks, to enable quick updates. The EXE indicator follows the queue, i.e. is switched ON as the event is put into the queue, and switched OFF when the queue is emptied.

In case a large number of messages from AutroSafe overflows the buffer, the quick update will not be maintained, however each register is updated, and by the transfer of all blocks no data will be lost.

At 9600 Baud the time to transfer one block is approximately 110ms. The response time of the Slave defines the majority of the delay to send the next block. Especially if this delay time is considerable, throughput and time delay may be improved if some of the system registers are skipped (by setting the length parameter in the Config.txt file).

This may be an option if for instance the Wathcdog or Date / Time register is not used.

The total number of registers should be kept to a proper minimum, i.e. no gaps in the sequence of registers, but still some space for possible future expansions.

6.6 AutroCom formatted Configuration

Each line of Config represents one line (or part of a line) of a table. The general layout is:

```
<TableId[Index]>;<Value1>;<Value2>;… // Comment
```

Each <ValueN> is encoded as **<FieldName=Value>**

6.7 Short Description of the BSL-330 Configuration Tables

The BSL-330 Configuration consists of a number of tables (a plain text file), including:

- The General Settings Table
- The Status Register Table
- The Command Register Table

Each table consists of a number of lines. Each table line can be configured using one of more text lines.

A short overview of the fields in each table is included below. For detailed information on each field in the BSL-330 Configuration Tables, refer to separate chapter 13.

Table	Fields
General Settings	`// General settings`
	`//-----------------`
	`Settings[1]; SlaveAddress=1;`
	`Settings[1]; AcceptFaults=F;  // T=(true)Automatic accept, F=(false)No accept`
	`Settings[1]; CmdHandshake=T;  // T=(true)Command READY bit, F=(false)None`
	`Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always`
Status Register	`// Table of AutroSafe status registers`
	`//-----------------------------------`
	`Statuses[1]; Name=AutroSafe; Type=As; Register=30001; NoOfRegs=1;`
	`Statuses[2]; Name=WatchDog ; Type=Wd; Register=30002; NoOfRegs=1;`
	`Statuses[3]; Name=Points   ; Type=PT; Register=30003; FirstUnitNo=1; LastUnitNo=512;`
	`Statuses[4]; Name=Outputs   ; Type=FP; Register=30501; FirstUnitNo=1; LastUnitNo=200;`
	`Statuses[5]; Name=Sounders ; Type=FD; Register=30601; FirstUnitNo=1; LastUnitNo=100;`
Command Register	`// Table of AutroSafe command registers`
	`//-----------------------------------`
	`Commands[1]; Name=Commands ; Type=Cm; Register=40001; NoOfRegs=3;`

6.8 Example of BSL-330 Configuration

Config is a plain text file.

```
// Config file for BSL-330-1 Modbus Slave
//---------------------------------------
//
// General settings
//-----------------
Settings[1]; SlaveAddress=1;
Settings[1]; AcceptFaults=F;      // T=(true)Automatic accept, F=(false)No accept
Settings[1]; CmdHandshake=T;      // T=(true)Command READY bit, F=(false)None
Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always
//
//
// Table of AutroSafe status registers
//------------------------------------
Statuses[1]; Name=AutroSafe; Type=As; Register=30001; NoOfRegs=1;
Statuses[2]; Name=WatchDog ; Type=Wd; Register=30002; NoOfRegs=1;
Statuses[3]; Name=Points   ; Type=PT; Register=30003; FirstUnitNo=1; LastUnitNo=512;
Statuses[4]; Name=Outputs   ; Type=FP; Register=30501; FirstUnitNo=1; LastUnitNo=200;
Statuses[5]; Name=Sounders ; Type=FD; Register=30601; FirstUnitNo=1; LastUnitNo=100;
//
// Table of AutroSafe command registers
//-------------------------------------
Commands[1]; Name=Commands ; Type=Cm; Register=40001; NoOfRegs=3;
```

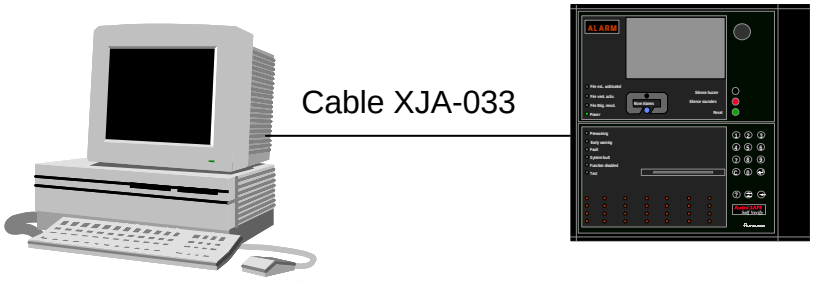
- Config consists of a number of tables (here: Settings, Statuses, Commands)
- Each table consists of one or more lines (like the Statuses table)
- Each table line can be configured using one of more text lines (like the Settings[1])

The index “[1]” of each table line is actually a **tag** that need not be sequentially increasing line by line. This means that you can temporarily remove a sub-table by commenting out the line, and there is no need to re-number the lines below.

(When Config is loaded, every new, unknown tag will cause allocation of “next free” memory address. Skipping tag values does not “reserve” memory unnecessarily).

7. Configuring the AutroSafe System

7.1 Introduction



The procedure deals with the configuration of the AutroSafe Interactive Fire Alarm System. The AutroSafe Configuration Tool is used for this purpose.

The chapter includes the following:

- Configuring the AutroSafe System
- Connecting the cable for downloading
- Downloading the AutroSafe Configuration

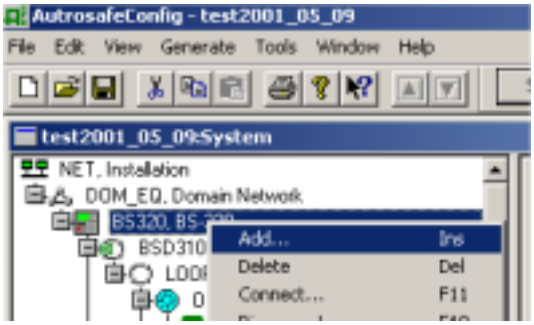
7.2 Configuring the AutroSafe System

The necessary configuration of the AutroSafe includes the following:

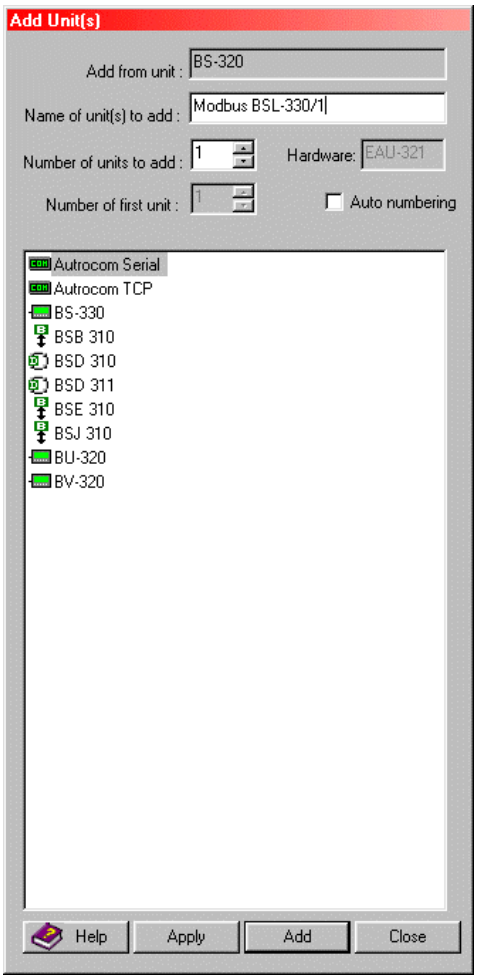
- From the Main Menu in AutroSafe Configuration Tool, click on *View* and select *System* (*System View*).
- In the Tree View on the left side of the screen, click on the Panel (BS-320) where the AutroCom Serial is to be added.

  Note: Make sure that the selected panel is actually the one where the Serial Port Communication Board EAU-321 is mounted.

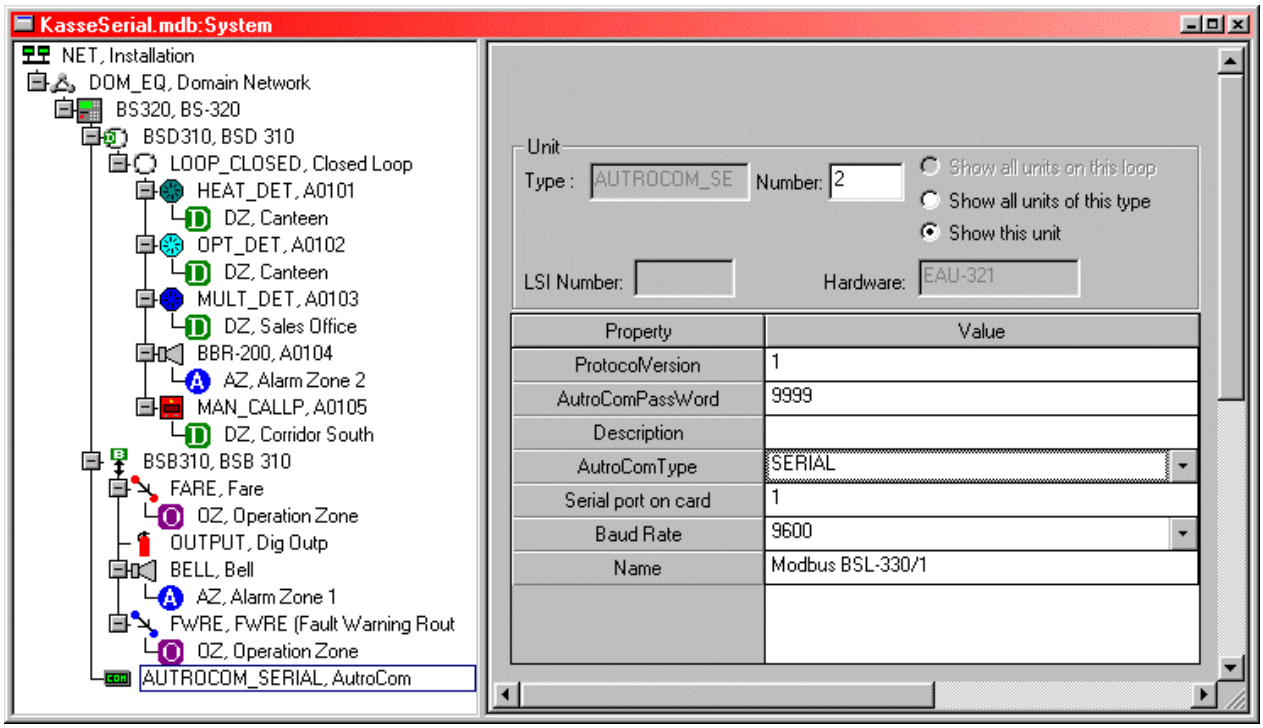
- Right-click the mouse and select *Add*.



- In the popup menu that appears, write the name of unit to be added, and state the number of units to be added (if necessary).

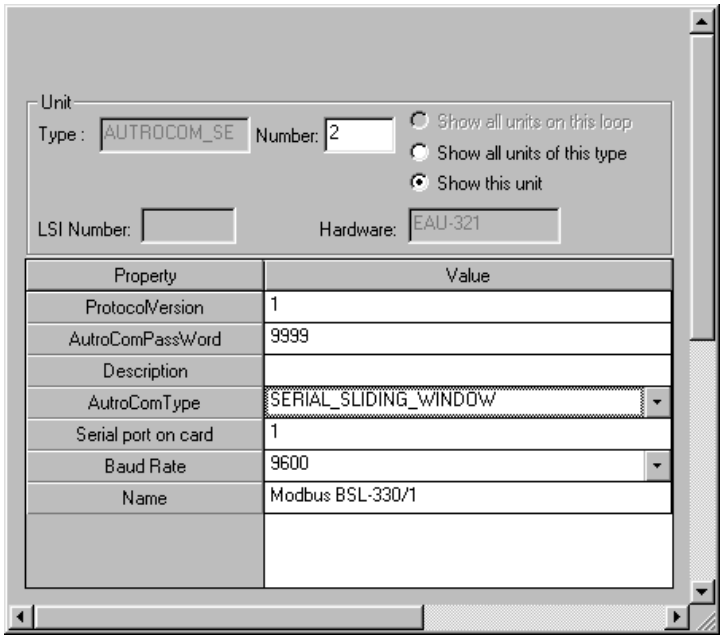


- Click on *AutroCom Serial* in the Entity window, then click on the *Add* button.
- In the Tree View, click on the AutroCom Serial (in this example named AUTROCOM_SERIAL_Modbus).



- Select port number, 1 or 2.
- Verify the parameter settings (baud rate to 9 600 baud, 8 bits, none parity, 1 stopbit).

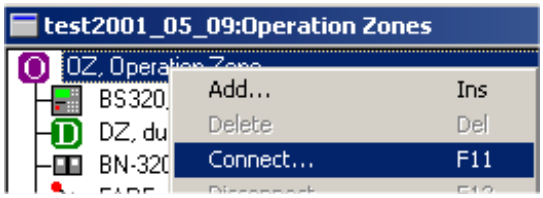
- Set the AutroCom Type to SERIAL_SLIDING_WINDOW in the drop-down box to the right.



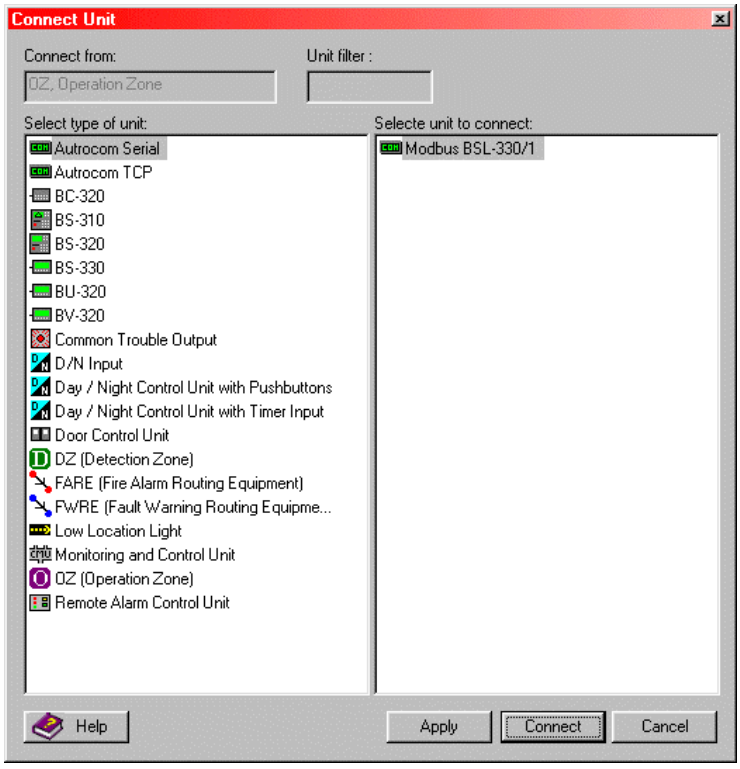
- From the Main Menu, click on *View* and select *Operation View*.
- In the Tree View on the left side of the screen, click on the top level OZ (Operation Zone) – that is, if there are several Operation Zones in the AutroSafe system. Note: The BSL-330 has to be connected to OZ1, that is the top level

Operation Zone.

- Right-click the mouse and select *Connect.*

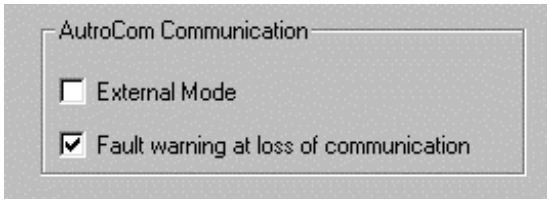


- In the popup menu that appears, select the *PLC Equipment* (in this example we have given the Unit this name), then click on the *Connect* button.



- In the Tree View, verify that the AutroCom Serial (in this example, *PLC Equipment*) is connected to the correct OZ (Operation Zone).

- From the Tool Menu, select Site Configuration System Settings.
- If you want fault warning in case of loss of communication, tick off this selection as shown below.



(The dialogue box Site Configuration System Settings automatically pops up when you start a new configuration).

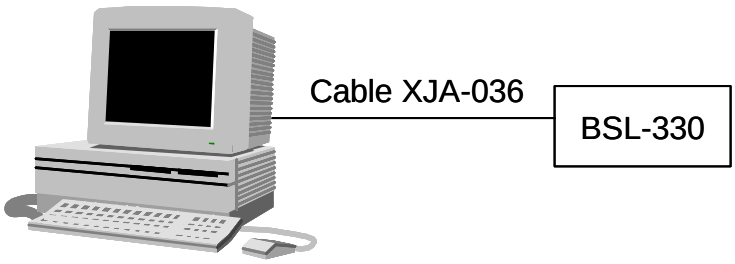
7.3 Downloading the AutroSafe Configuration

For detailed information on the Configuration and Commissioning Procedure for AutroSafe, refer to the *Commissioning Handbook.*

NOTE:
When the downloading is completed and the system is running (normal operation), a fault warning will occur as the third party Modbus compatible equipment / PLC equipment at this stage is still not connected (i.e. no equipment connected to AutroCom Serial).

8. Preparing the BSL-330-Converter

8.1 Introduction



The BSL-330 is delivered with a standard setup (parameter settings) from the factory. This chapter provides information on this standard setup.

The KD-485 Configuration Program is used for this purpose (chapter 3.1).

The preparation of the BSL-330 Converter includes the following:

- Setting dip-switches
- Connecting the cable
- Entering Executive Mode
- Setting parameters

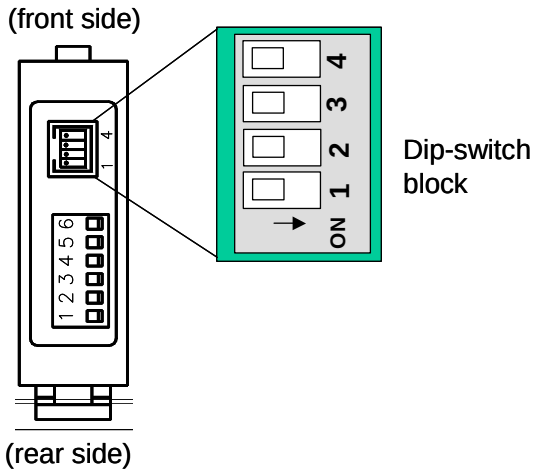
8.2 Dip-switch Settings

The illustration below shows the dip-switch settings on the BSL-330 Converter.

Switch 1 = ON for RS-485 / 2-wire
Switch 1 = OFF for RS-422 / 4-wire
Switch 2 = OFF
Switch 3 = OFF
Switch 4 is not used.

The rotary switch on the front panel must be set to 0.

Top View of BSL-330 Converter

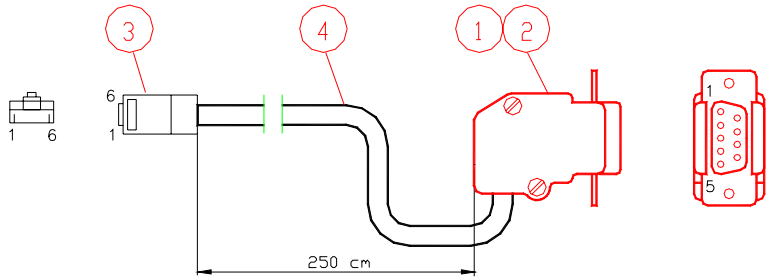


8.3 Connecting the Cable

Before entering Executive Mode (EXE) and setting the required parameters, the necessary cabling must be done.

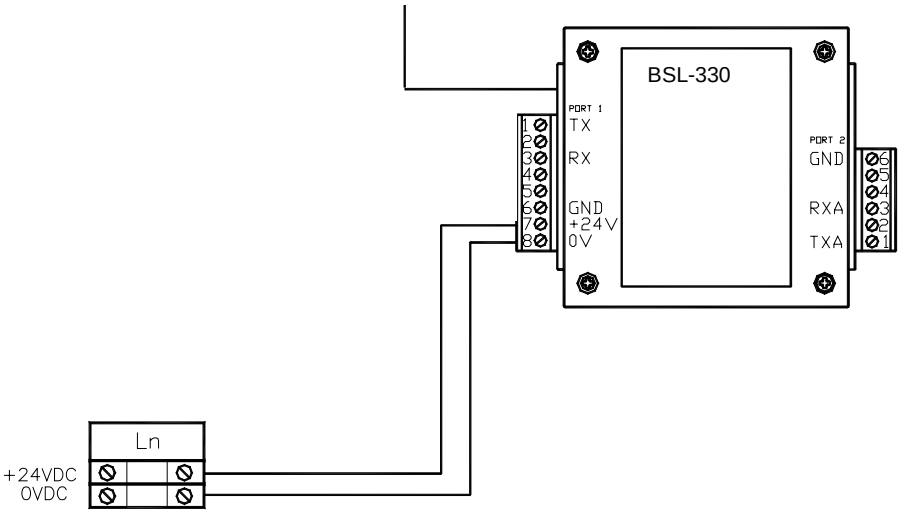
- Consult the cable drawing below.
- Connect the cable from the 24V DC power source to the connections 7 and 8 (Port 1) on the BSL-330 Converter.
- Connect the cable from the computer's serial port to the connector (Port 1) on the BSL-330 Converter.

Communication Cable XJA-036
is used between the computer and Port 1 on the BSL-330 Converter.



NOTE: If the port 1 on the BSL-330 is connected to AutroSafe, the cable has to be disconnected before doing the necessary parameter settings via the computer.

Test cable XJA-036

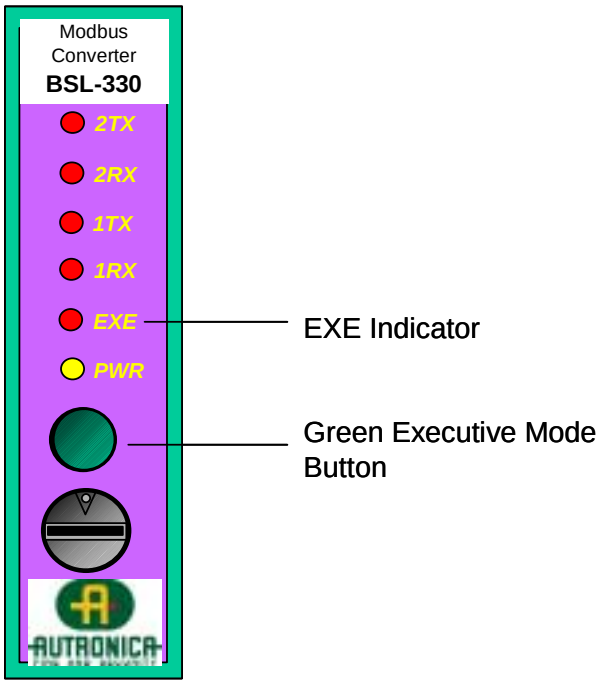


8.4 Entering Executive Mode (EXE)

The BSL-330 Converter must be electronically configured before it can be used. Configuration must be done via Port 1, which has to be set to *Executive Mode*.

- To enter Executive Mode, press and hold down the green *Executive Mode button* on the front panel approximately 5 seconds until the EXE indicator starts blinking, then release it.

A few seconds later (approximately 3-4 seconds), the red EXE indicator will blink rapidly (1second ON / 1 second OFF), and you can start the configuration program (KD485).

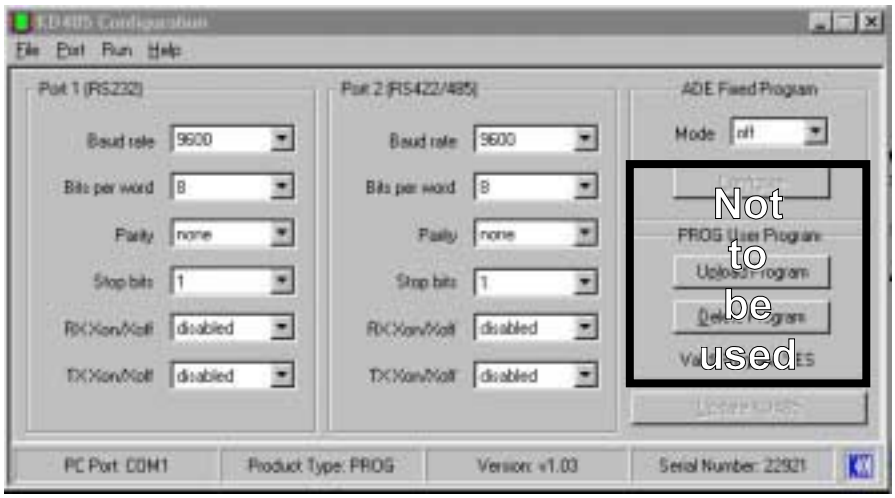


8.5 Setting Parameters / KD485 Configuration Program

The parameter settings for Port 1 *(AutroSafe)* and Port 2 (Third party Modbus compatible equipment / PLC equipment) are done by means of the KD485 Configuration Program, which is delivered with the BSL-330 Converter.

Note that the only reason for changing the port settings is if the standard value for the AutroCom baud rate has been changed. If so, the following applies:

- Make sure that the BSL-330 Converter is in Executive Mode. The EXE indicator should be blinking rapidly. If not, communication is not established, and you must repeat the procedure described in the previous section (*Entering Executive Mode)*.
- Start KDCFG.EXE, and the Configuration Menu will appear on screen.
- Verify that Mode is set to OFF (on the right uppermost side).



- Set the baud rate for Port 1 *(AutroSafe)* to 9 600 baud, 8 bits, none parity, 1 stopbit, (which is the default setup of AutroSafe).
  Note that these parameters can be changed for AutroSafe by means of the AutroSafe Configuration Tool.

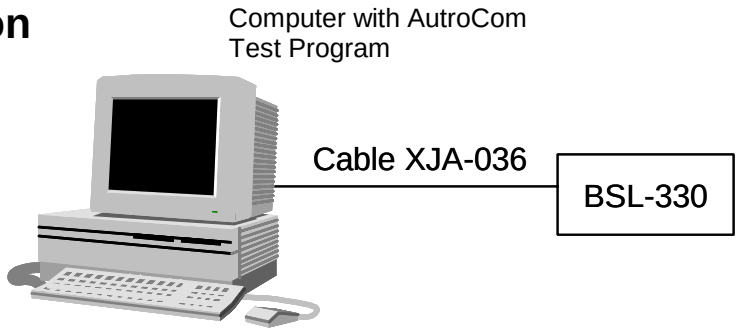
- Choose RX Xon/Xoff *disabled*
- Choose TX Xon/Xoff *disabled*
- Port 2: Note that the appropriate parameters for Port 2 (PLC Equipment) are configured in the Modbus Configuration file and overrides the settings configured in the KD485 Configuration Program. If the settings for Port 2 are omitted in the BSL-330 Configuration file, the settings must be modified according to the connected Modbus compatible equipment.
- Click on the highlighted button marked *Update KD485* and the message *Writing new KD485 Configuration* will appear on screen.

When the message disappears, and the *Update KD485* button no longer is highlighted, all parameters have been set and the configuration is completed.

NOTE: If you later want to check the port settings, simply start the KDCFG.EXE again. It will read out the actual settings from the BS-330 module before displaying the configuration window.

9. Configuring the Customized Setup of the BSL-330-Converter

9.1 Introduction



The procedure deals with the setup (parameter settings) related to the third party Modbus compatible equipment / PLC equipment that is to be used. The AutroCom Test Program is used for this purpose (chapter 3.1).

This chapter includes the following:

- Connecting the cable (refer to previous chapter 8.3.)
- Configuring the BSL-330 Converter
- Loading the BSL-330 Configuration using the AutroCom Test Program
- Setting up the communication
- Using the AutroSafe Emulator (in the tools menu / AutroCom Test Program) to:
  - Edit the BSL-330 Configuration (if necessary)
  - Send the BSL-330 Configuration
  - Test the BSL-330 Configuration

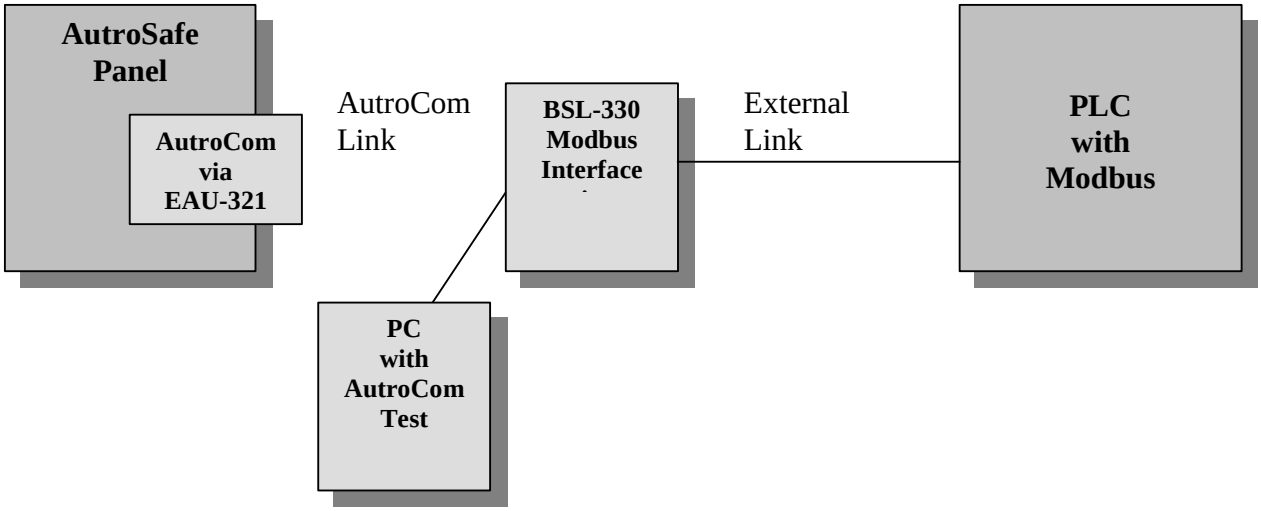
9.2 Configuring the BSL-330 Converter

- The configuration of the BSL-330 Converter is described in detail in chapter 13.
- The necessary tables are included in chapter 13.

The configuration deals with the following tables:

Table	Fields
General Settings	`// General settings`
	`//-----------------`
	`Settings[1]; SlaveAddress=1;`
	`Settings[1]; AcceptFaults=F;  // T=(true)Automatic accept, F=(false)No accept`
	`Settings[1]; CmdHandshake=T;  // T=(true)Command READY bit, F=(false)None`
	`Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always`
Status Register	`// Table of AutroSafe status registers`
	`//-----------------------------------`
	`Statuses[1]; Name=AutroSafe; Type=As; Register=30001; NoOfRegs=1;`
	`Statuses[2]; Name=WatchDog ; Type=Wd; Register=30002; NoOfRegs=1;`
	`Statuses[3]; Name=Points   ; Type=PT; Register=30003; FirstUnitNo=1; LastUnitNo=512;`
	`Statuses[4]; Name=Inputs   ; Type=FP; Register=30501; FirstUnitNo=1; LastUnitNo=200;`
	`Statuses[5]; Name=Sounders ; Type=FD; Register=30601; FirstUnitNo=1; LastUnitNo=100;`
Command Register	`// Table of AutroSafe command registers`
	`//-----------------------------------`
	`Commands[1]; Name=Commands ; Type=Cm; Register=40001; NoOfRegs=3;`

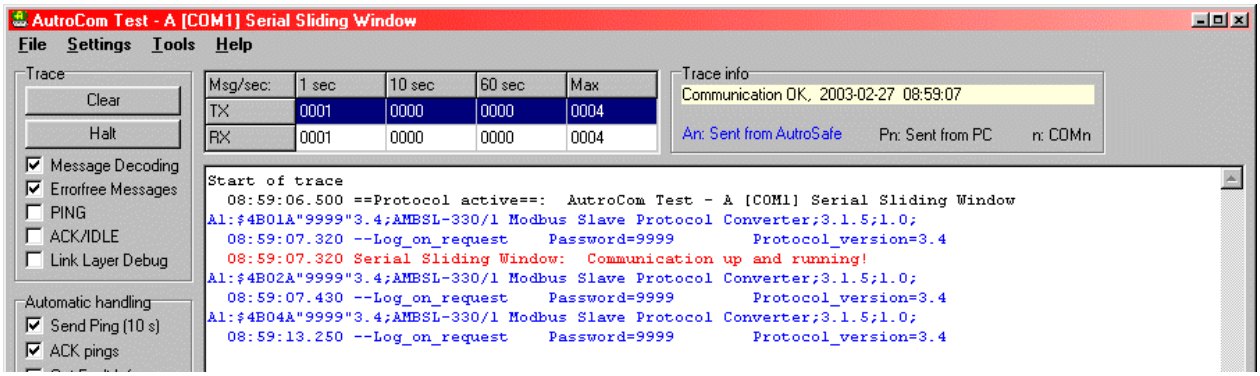
9.3 Loading BSL-330 Configuration using AutroCom Test Program



AutroComTest is a communication test program that has some additional functionality that is used here. It is used to send Config into BSL-330, and it can generate data messages for FireAlarm, Fault etc. so that the paging functionality can be tested.

- Connect the PC to BSL-330s port 1 (or the RJ-45 Config port)
- Start AutroComTest.exe

The program's main window is a protocol trace window. It will show that BSL-330 sends "Log_on_request" every 10 seconds. The very first time this program is run, you may have to set up communication parameters, see below.

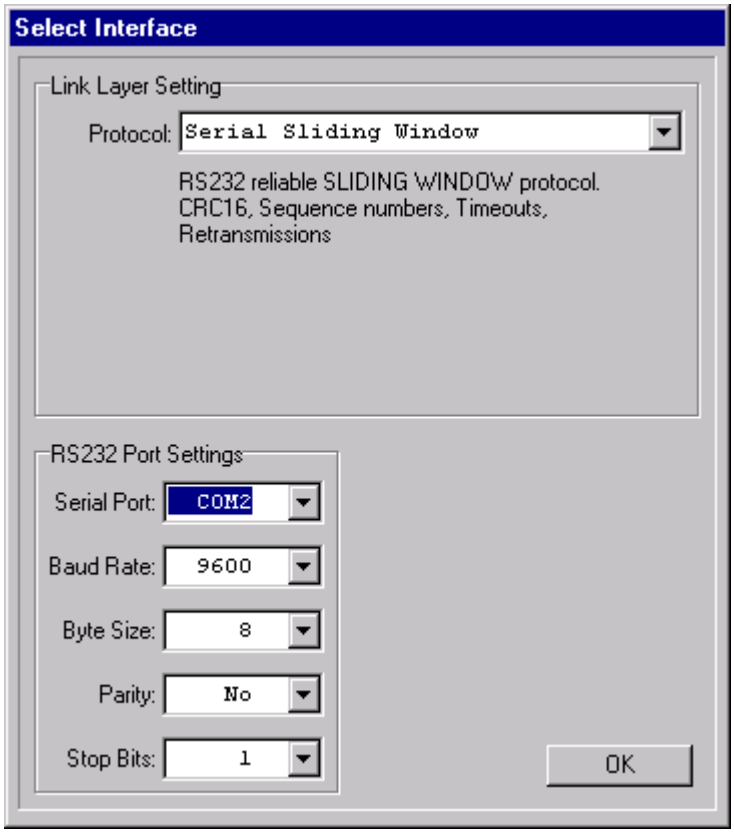


9.4 Setting up Communication

Select the “Settings” menu entry, then sub-entry “Com Port and Protocol…”

- The “Protocol” is “Serial Sliding Window”.
- The default AutroCom port settings are shown; adjust them if necessary. (Byte sizes, Parity and Stop bits are normally not changed).

Finish by pressing the “OK” button. The main window will show the “Log-on-request” messages within 10 seconds.

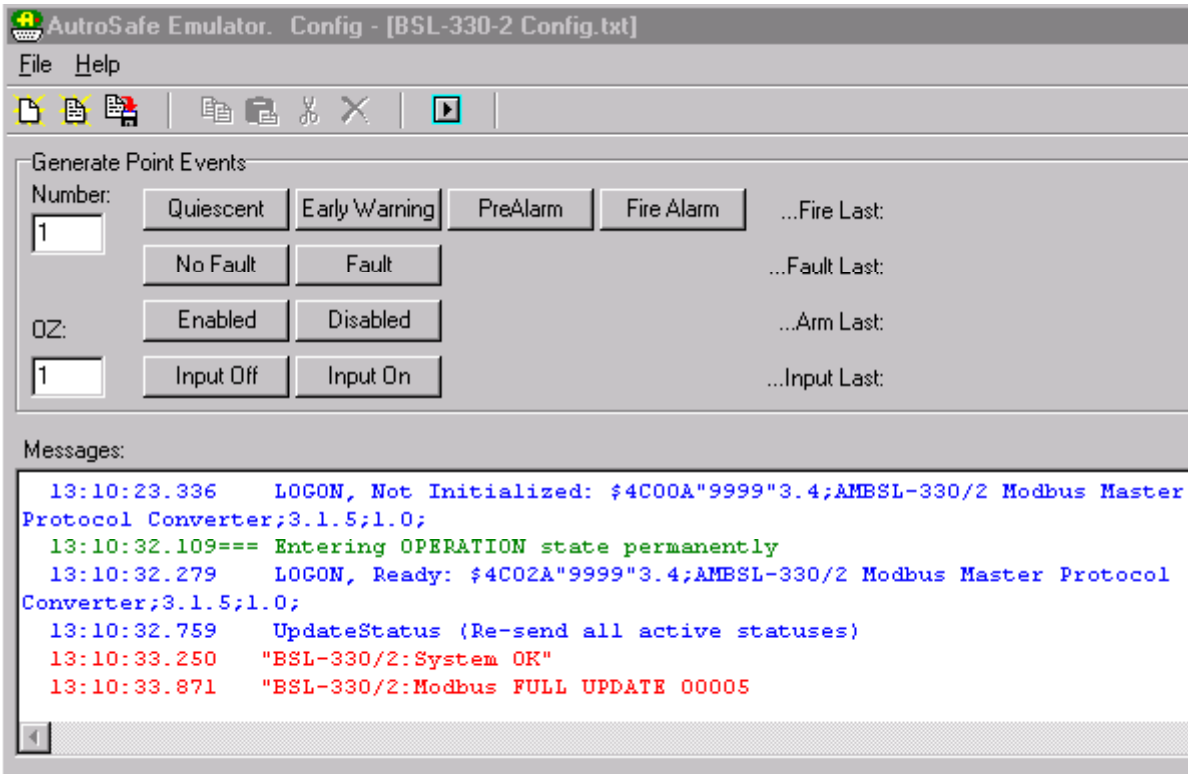


9.5 The AutroSafe Emulator

- Select the menu entry “Tools”, then sub-entry “AutroSafe Emulator”.

A new window appears. Wait some 20 seconds while “RESET” and “INIT” phases are simulated, and the text “Entering OPERATION” appears. You will see the “LOGON” attempts from BSL-330 during this period.

(The screenshot shows a situation where the Third party Modbus compatible equipment / PLC equipment is not connected).

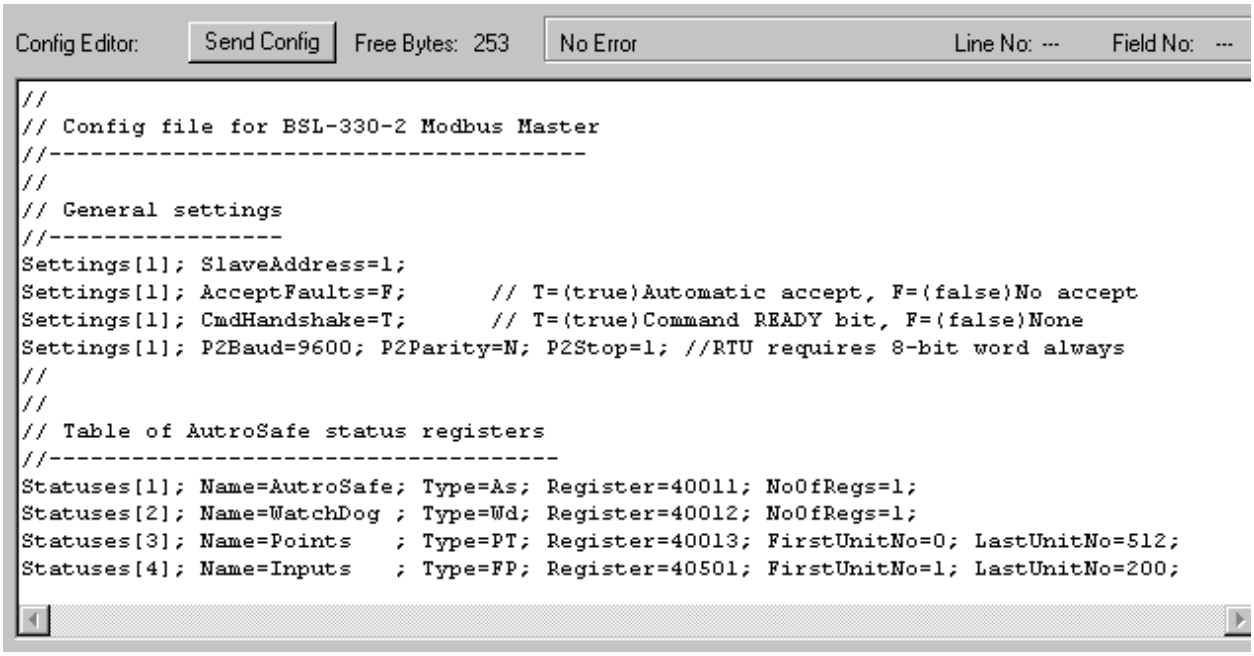


9.5.1 Editing the BSL-330 Configuration

If necessary, the BSL-330 Config text file can be edited using any editor, for example Notepad. To test and modify it quickly, you can also edit it directly in the AutroSafe Emulator.

- Read your Config by selecting the "File" menu, sub-entry "Open…"
  (alternatively, click the  button).

A standard Windows File dialog appears, where you can navigate directories and select a file. If you have used the program before, the name of the file you used last will come up pre-selected.



You can now edit the text. It will be saved automatically when you click "Send Config".

9.5.2 Sending the BSL-330 Configuration

- Click the "Send Config" button. The Config is transferred line by line in just a few seconds. The screen field "Free Bytes" is updated continuously.

A successful transfer gives this status:

If BSL-330 is unhappy with the Config, an error indication is returned:

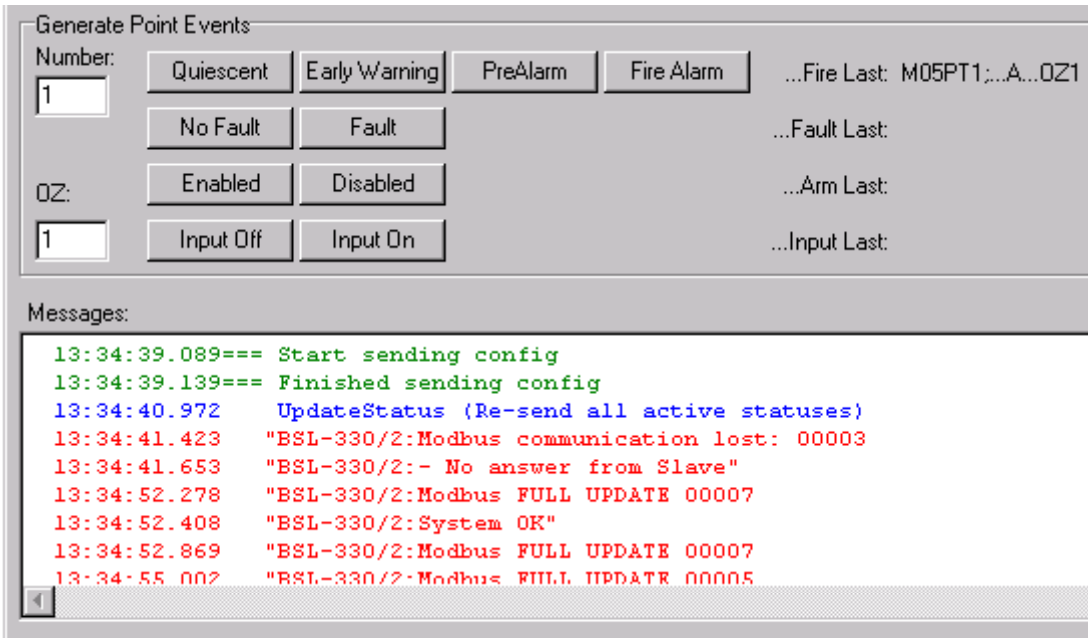
You then must navigate to line 10, and inspect the 3rd value.

9.5.3 Testing the BSL-330 Configuration

As soon as a valid Config has been transferred to BSL-330, you can test and verify that the desired events from AutroSafe will generate paging calls.

(At this point you must have a functioning communication with the Third party Modbus compatible equipment / PLC equipment. The trace below shows what happens when the equipment is plugged in).

All messages in the trace that starts with "BSL-330: …" have been returned from BSL-330, and shown internal status from it.

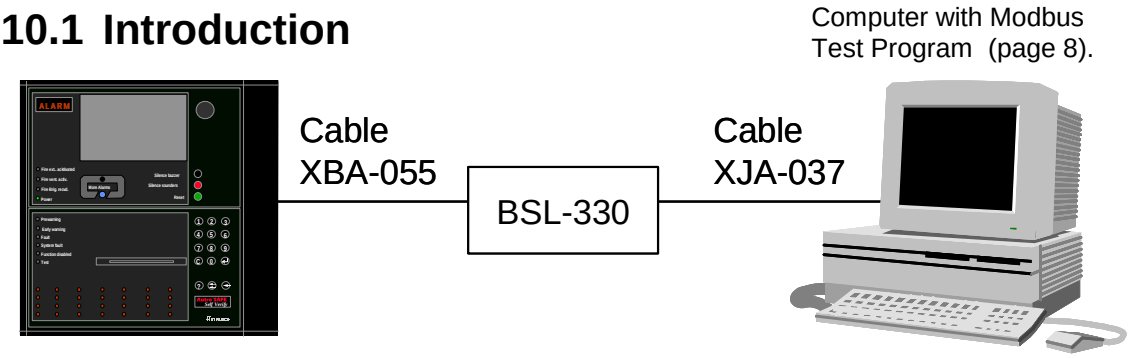


The example shown a Fire Alarm from the point with Unit ID 1. If necessary, go back to "Edit Config" and repeat the send/test procedure.

NOTE:
Register addresses may have changed when Config have been edited. BSL-330 handles this automatically by first fetching all current AutroSafe status ("Update Status" in the trace).
In a BSL-330-2 Master, the whole register block is sent to the PLC ("FULL UPDATE" in the trace).
In a BSL-330-1 Slave, all data are fetched continuously by the PLC, and no "FULL UPDATE" trace will be shown.

10. Verifying the Customised Setup of the BSL-330-Converter

10.1 Introduction



The procedure verifies that the customised setup is successful.
The Modbus Test Program (Mdbus.exe) is used for this purpose (page 8).

This chapter includes the following:

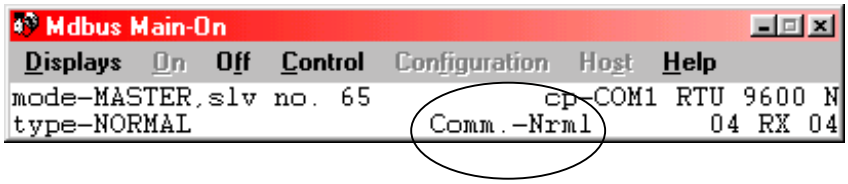
- Connecting the cables (refer to chapter 3.4.1 and 3.4.3)
- Verifying the customised setup of the BSL-330 Converter

10.2 Verification Procedure

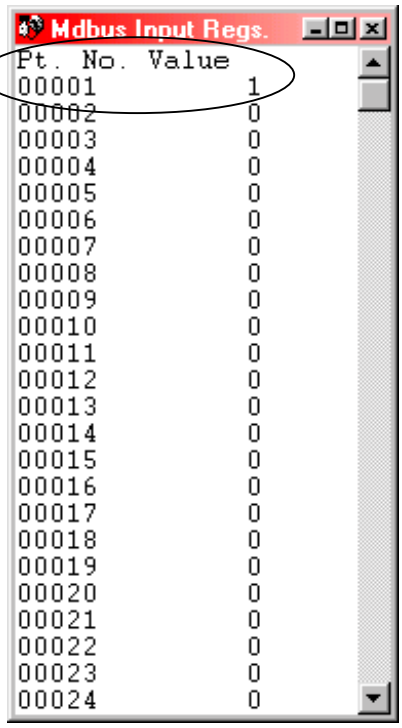
It is possible to test the BSL-330 without having a complete running setup.

- Connect a PC to BSL-330 port 2.
- Open the serial port with correct settings.
- Activate the Modbus communication.
- Verify that the register changes (Modbus Test Program; see registers below) are correct according to the events that are generated on the AutroSafe panel.

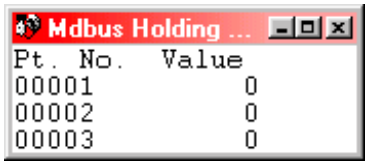
Program Window



Input Register

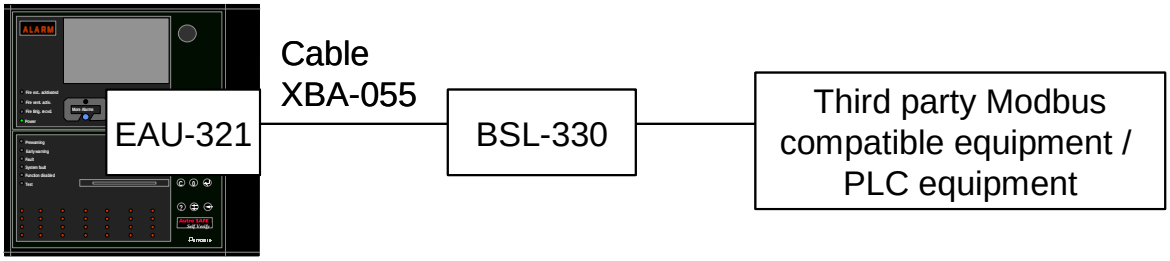


Holding Register



11. Verifying the Modbus Compatible Equipment with a complete system setup

11.1 Introduction



The procedure provides information on how to verify the paging functionality with a complete system setup. The AutroSafe system is used to activate various events, i.e. fire alarms, prealarms, fault messages, texts etc.

NOTE:
Before activating events by means of the AutroSafe Interactive Fire Alarm System, disable or disconnect:

- **the signal to the Fire Brigade**
- **sounders**
- **voice alarms**
- **other audible / visual indicators**
- **output controls activating fire doors and ventilation**

If a graphical system, such as AutroMaster or AutroOS is used, make sure to inform the operators that alarm or events from a test will appear.

The procedure includes the following:

- Connecting the cable between AutroSafe and Port 1 on the BSL-330 Converter (refer to chapter 3.4.1)
- Connecting the cable between Port 2 on the BSL-330 Converter and the third party Modbus compatible equipment / PLC equipment
  (Normally the cable is delivered with the third party Modbus compatible equipment / PLC equipment. BSL-333 has screw connectors).
- Verifying the complete system setup (refer to Verification Procedure on next page).

11.2 Verification Procedure

NOTE:
Before activating events by means of the AutroSafe Interactive Fire Alarm System, disable or disconnect:

- **the signal to the Fire Brigade**
- **sounders**
- **voice alarms**
- **other audible / visual indicators**
- **output controls activating fire doors and ventilation**

If a graphical system, such as AutroMaster or AutroOS is used, make sure to inform the operators that alarm or events from a test will appear.

- Verify that the following AutroCom events are indicated:

o fire alarms
o prealarms
o faults

It is important to verify that the installation is working according to the intention set in the Configuration. As there are several, independent configurations, at least some sample testing must be made.

A step-by-step verification recommended is:

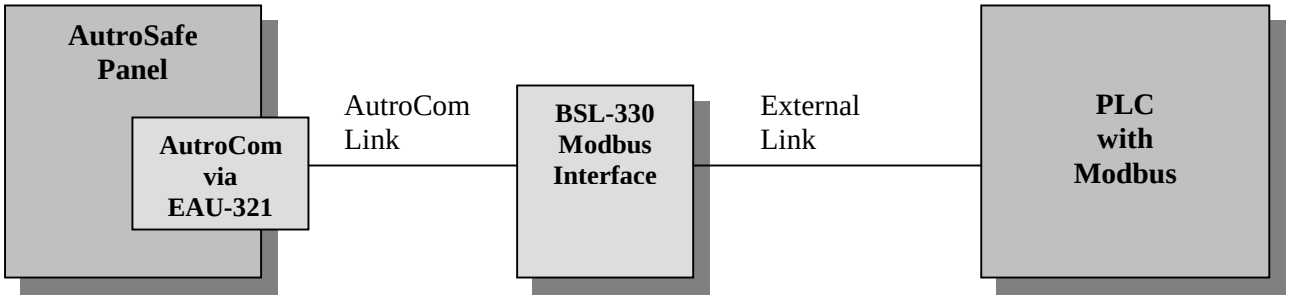
- Make a list of all detectors that affects the PLC system
- Identify these detectors in terms of their UnitID and the Tag name. This should again be reflected in a geographical / physical location overview of detectors.
- Make (if not available) a cause/effect diagram of the detector to output actioning.
- Verify that each detector actions the correct output
- Verify that Silence and Reset from the PLC is actioned in the AutroSafe system
- Verify that the Initialisation command from the PLC initialises the AutroSafe system
- Verify the Disable command to a few detectors and FPEs
- Verify the Inhibit command (if supported)
- Verify the Set Date&Time to set the correct time
- Verify that the Faults are accepted in AutroSafe according to the requirements (Auto-accept set to ON or OFF)
- Verify that communication breaks in AutroCom or ProfiBus cabling is reported correctly

If any of the above fails, refer to Troubleshooting, Chapter 12.

12. Troubleshooting

12.1 Self Monitoring

The functionality involves a number of hardware boxes and wires that may fail.



The BSL-330 implementation tries to monitor and report as much problems as possible. All faults described below on the AutroSafe panel display are related to the AutroCom port, which should have a meaningful name like ”Data link to Control Room” in AutroSafe Config.

Hardware in fault	Monitored by	Reporting
AutroSafe EAU-321 serial board	Monitored by AutroSafe software. Detected within 10 seconds.	Fault indication on AutroSafe panel, ”Communication error” ”Loss of communication”
RS232 wiring from EAU-321 to BSL-330	As above	As above
	Monitored by BSL-330.	To PLC: BSL-330 sets the Modbus status register to “Communication Failure”
BSL-330 hardware (KD-485 box)	AutroSafe, as above	AutroSafe panel, as above

As the BSL-330 is located inside the AutroSafe cabinet, it’s most likely that hardware problems occur on the outside of BSL-330. BSL-330 then can use AutroSafe’s panel for fault reports.

Hardware in fault	Monitoring	Reporting
RS232 wiring to PLC	Monitored by BSL-330 software. Detected within 10 seconds.	Fault on AutroSafe panel, ”Communication error” ”Protocol Converter Fault”, (see table on next page)
PLC	As above	As above

In AutroSafe’s display you will find a FAULT WARNING,
with the text **“Protocol Converter Fault”.**
In addition, there are some numbers called **DATA: Value 1, value 2, value 3.**

Value 1	Error type:	
1	Communication problem	
	Value 2	
	1	Modbus master: one message bad, checksum error
	2	Modbus master: slave missing (communication lost)
	3	Modbus master: slave message too short. The slave may not recognize the referenced register, or just line noise.
	4	Modbus slave: PLC does not poll me (communication lost) Based on a configurable timeout. Ref. `Settings[1]; PollTime=300;`
		Value 3: Register no in the data message that failed
2	Config problem	
	Value 2	
	1	Table *starts* past end of available memory block
	2	Table too big, *ends* past end of available memory block
	3	Table overlaps previous table
	4	FirstUnitNo is larger than LastUnitNo
		Value 3: Register no identifying the table causing problem

NOTE: From BSL-330 version 3.4.1, fault reporting for communication problems can be switched off in BSL-330's Config.

Ref. `Settings[1]; CommFault=F;`

12.2 Quick system overview

The LEDs of the KD-485 box gives immediate info:

12.2.1 AutroSafe communication (AutroCom protocol)

The LEDs labelled 1TX and 1RX are used for AutroSafe communication. AutroCom is an event driven communication: messages occur randomly, except for some periodic supervision traffic.

- **1RX** should flash at least every 3 seconds, indication data received from EAU-321.
  If constantly dark, check wiring. See also "

Missing communication" on page 67.
If flashing, but problems, the port settings (baudrate etc.) may be the problem.

- **1TX** should flash at least every 3 seconds, indicating transmission from BSL-330 to AutroSafe.
  If constantly dark, the Modbus program inside BSL-330 is not executing properly.

The self-monitoring of the AutroCom link by AutroSafe and BSL-330 is based on messages sent one way, and acknowledges going the other way. Thus, both data paths must be OK before the link is reported OK. In the case where wiring is OK, but port settings (baudrate etc.) is wrong, both ends will transmit periodically, causing both 1RX and 1TX to flash in a "normal" rate.
For advanced debugging, see separate chapter on AutroCom faultfinding.

12.2.2 PLC communication (Modbus RTU protocol)

The LEDs labelled 2TX and 2RX are used for Modbus. Modbus is a cyclic communication, where all information is constantly re-sent.

- **Master:**
  The BSL-330 Master (BSL-330/2 or BSL-330/4) takes initiative to communication.
  - **2TX** will flash whenever the BSL-330-2 tries to send data to the slave. Normally it's a continuous communication indicated by several flashes per second. If the slave does not respond, BSL-330-2 will re-try communication every 3 seconds.
  - **2RX** indicates data coming from the slave. When 2RX flashes, low level communication is working (correct wiring, baudrate, slave address, CRC checksum).
  Note that the Master does not send all data periodically. Rather, it sends a single register immediately when an AutroSafe event occurs, and all registers only in special full recovery situations.
- **Slave:**
  The BSL-330 Slave (BSL-330/1 or BSL-330/3) waits for messages from the PLC Master.
  - **2RX** flashes every time data is received from the Master. This indicates that wiring is OK, and that the Master tries communication on this line.
  - **2 TX** indicates data sent from BSL-330-1. BSL-330-1 will respond only to valid messages, (correct baudrate, slave address, CRC checksum) so 2TX flashing is an indication that most things work.

For advanced debugging, see separate chapter on Modbus system faultfinding.

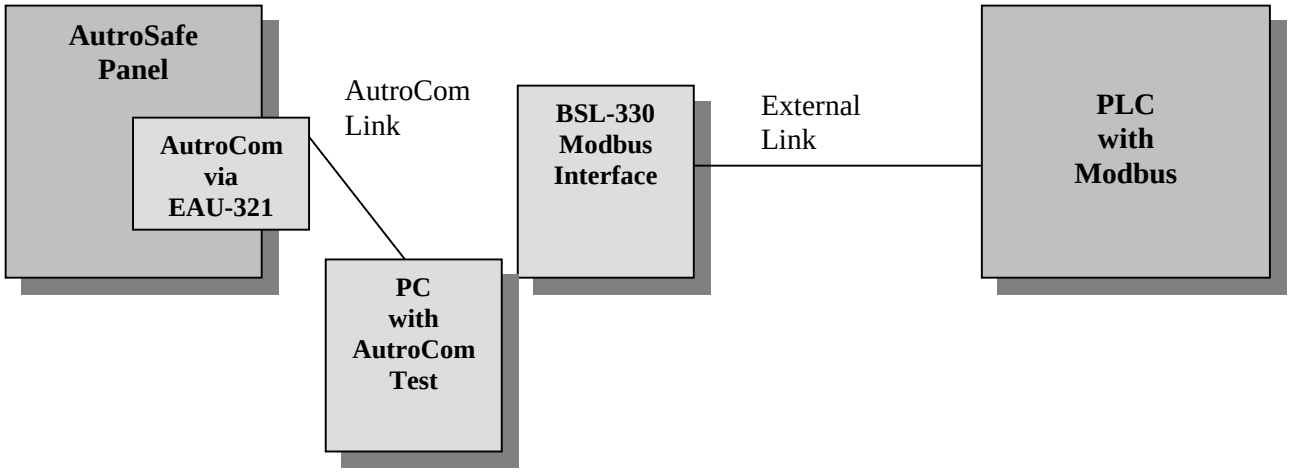
12.2.3 "Check wiring"

- A classic problem with RS232 links is that the RX and TX signals are connected RX-RX and TX-TX. Plain wire breaks (bad contacts) are also possible, of course.
  It's easy to verify RS232 signals using a Voltmeter, see below. NOTE: Measure the RX and TX signals at both ends of a link!
- All RS232 TX (output) signals should be NEGATIVE in the range –6V to –12V, with –8V as typical and you may even see –3V to –5V on some portable PCs. The voltage does not change much on a multimeter during data transmissions (which temporarily goes to PLUS 6V to 12V). A TX signal can't drive much current, and the voltage may drop a little (one or more Volts) when connected to a RX input.
- A non-connected RS232 RX (input) is typically below 0.5 V, and fluctuates when read.
- Note GND connections on the KD-485 box. All 3 GNDs are isolated from each other inside the KD-485. You must connect each of them to the proper external system, and do NOT strap them together nor "share" GND from another box.
  This applies also to voltage measurements; they are valid only relative to the same port's GND signal, no other!

12.2.4 "BSL-330 program not executing properly"

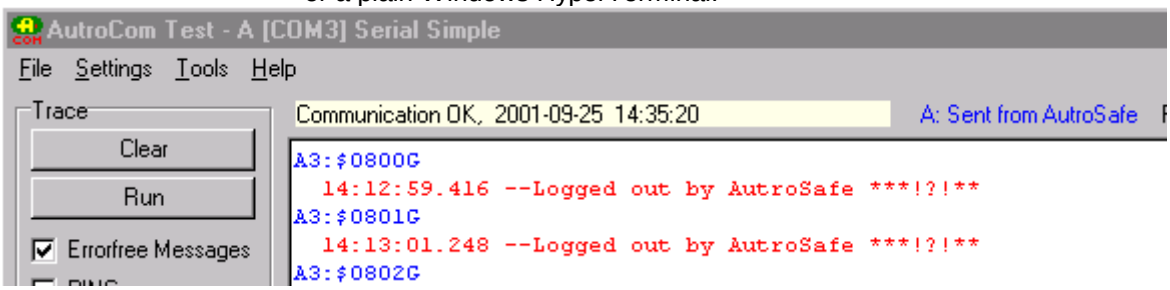
This is an abnormal situation. Return the BSL-330 to the factory. NOTE: The KD485 box can accidentally be configured into "ADE fixed program mode" different from "Off". In this case the KD485 will be running a built-in level converter program, which basically receives on one port, and sends on the other, possibly converting baudrates and/or electric interface. The port 1 LEDs and port 2 LEDs flashes in pairs RX/TX. Run KDCFG.EXE and check the "ADE" setting before giving up the unit!

12.3 AutroCom problems on the AutroSafe side



12.3.1.1 Verify communication

AutroCom starts running during the “Start initialization” operation. That is, it is running when the AutroSafe display shows “Panel is not initialized”.
When AutroCom is running it sends a message `$0BxxGxxxx` every two seconds. This is easy to verify with the AutroCom Test program, or a plain Windows HyperTerminal.



12.3.1.2 Missing communication

AutroSafe expects the external computer to log on within a few seconds after startup. If no logon occurs, the AutroSafe display gives a “Fault warning”, “Other faults”, with the name text of the AutroCom link (name as entered in AS Config). Press AutroSafe’s ENTER button on this message, and you will see fault info “Loss of communication”. The fact that this error message is generated indicates that configuration and serial hardware is present in AutroSafe.

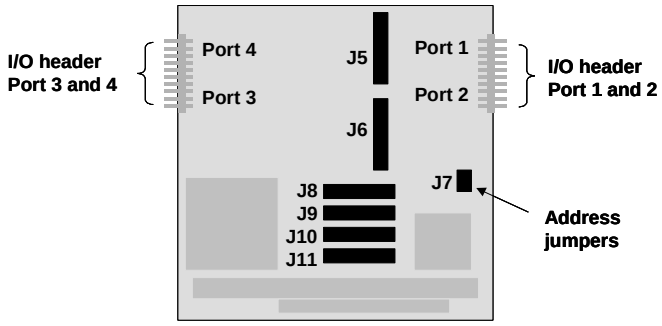
Missing communication can have several reasons:

- Wrong port set up in AutroSafe Config.
  The AutroSafe Config must have the AutroCom port set on the same LON node as the EAU-321 board is mounted! Re-check the port numbering plan.
- EAU-321 not set up correctly.
  Check that the flat cable running from EAU-321 is connected on port 1/2 and is turned correctly (red line close to pin 1 in connector, “up” on EAU-321, “down” on screws). Check that all jumpers are correct: See drawing on next page.
- Communication parameter (baud rate etc.) mismatch between AutroSafe and the external computer. This will show up in the AutroCom test program as garbage characters appearing with 2 seconds bursts.

12.3.2 Jumpersettings

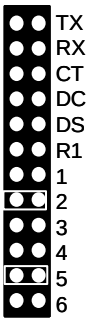
- Verify that all jumpers on the EAU-310 board and connections to the board are correct (see next page).

The table below gives an overview of the jumper settings for the Serial Port Communication Board EAU-321.

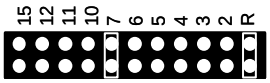


Serial Port Communication Board EAU-321

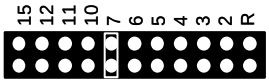
Jumpers J5 and J6:
J5 and J6 must be set to interrupt 2 and 5.



Jumpers J8 (interrupt)
J8 must be set to interrupt 7 and R.



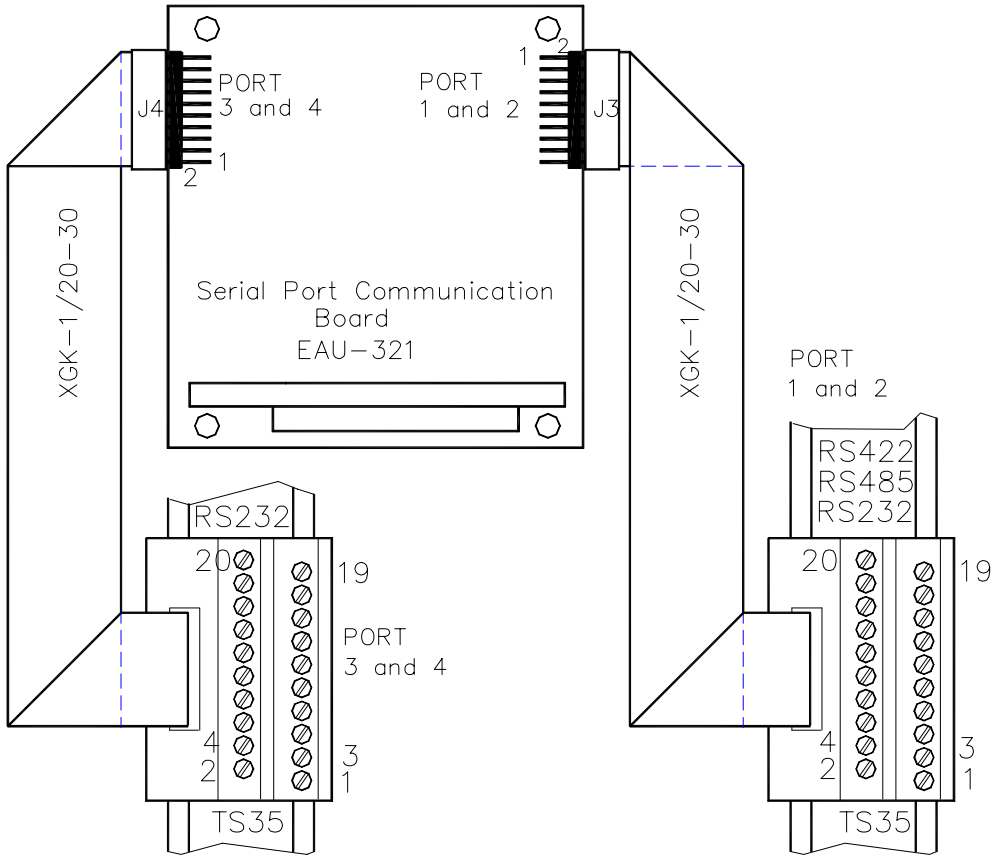
Jumpers J9, J10 and J11 (interrupt)
All ports must be set to interrupt 7.



Jumper J7 (board address)
Jumper in position A and B must be set to In.
This setting applies to all communication boards.
Gives board address 100h.

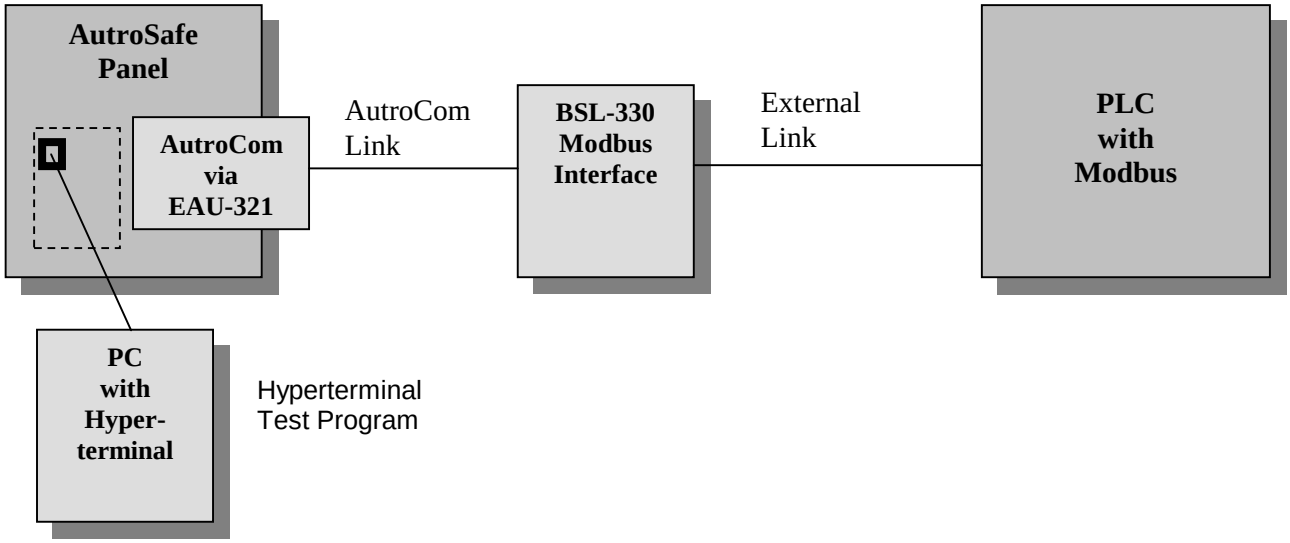
Connections on Terminal Blocks X1 and X2 *(if used)*

	X1			
NC	20	19	GND	
RI 2	18	17	DTR 2	
CTS 2	16	15	TXD 2	Port 2
RTS 2	14	13	RXD 2	
DSR 2	12	11	DCD 2	
NC	10	9	GND	
RI 1	8	7	DTR 1	
CTS 1	6	5	TXD 1	Port 1
RTS 1	4	3	RXD 1	
DSR 1	2	1	DCD 1	



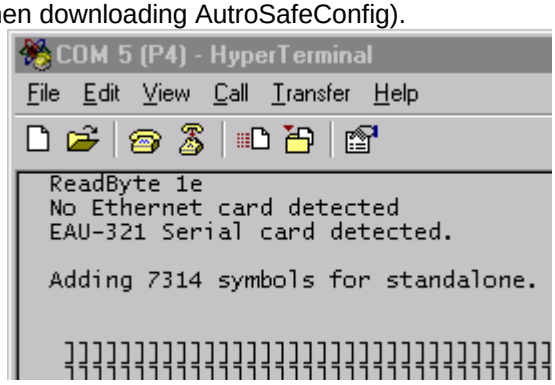
Terminal Block X2 *Terminal Block X1*

12.3.2.2 Verify configuration

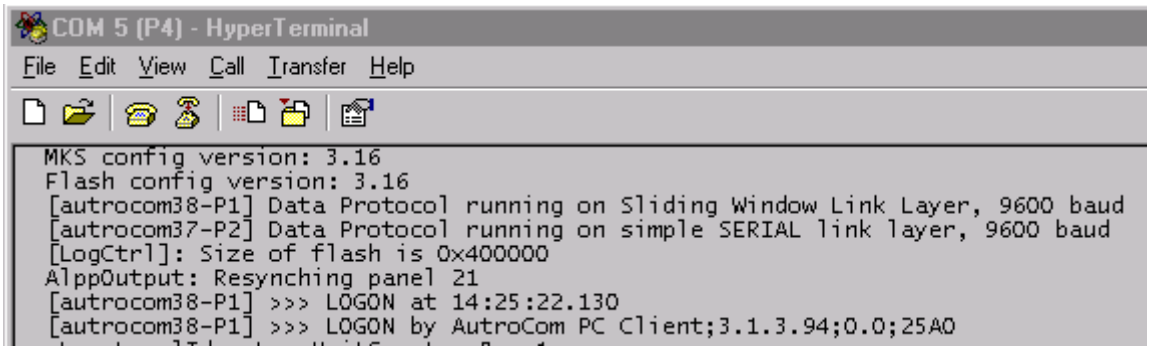


AutroSafe writes some trace during system start-up to the serial port on the EAC-300 that is used for loading of AutroSafe Config. The port runs on 9600 baud, 8 bit, no parity, 1 stop bit. Run a standard Windows HyperTerminal connected to this port. (Uses the same connections as used when downloading AutroSafeConfig).

Hardware detection takes place immediately after **system restart**. You will find two lines of text describing the status of possible AutroCom channels.

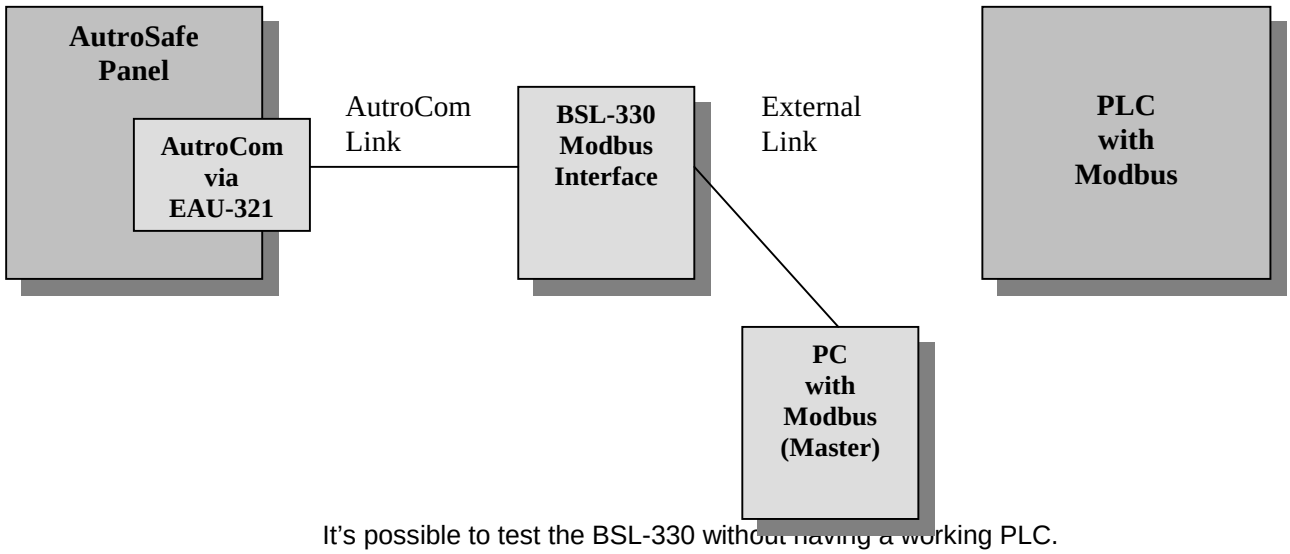


As the AutroSafe system starts up, more text is written to the terminal port.
Among the printout here you will find a line "`[autrocom99-P1] Data protocol running …`" `[autrocom38-P1]` shows both the Unit_ID of the channel (38), plus the port number of EAU-321 (P1). Unit_ID is the number you will find in AS Config when you select an AutroCom entry and inspect the details in the right part of the screen. (The number is assigned dynamically).
This text indicates that the AutroCom configuration and EAU-321 hardware is present.



Note also that the external system sends system info fields in it's LOGON message, it will show up here, thus making it easy to get version info etc. from BSL-330.
If AutroCom start-up is aborted for some reason, it will be printed here.

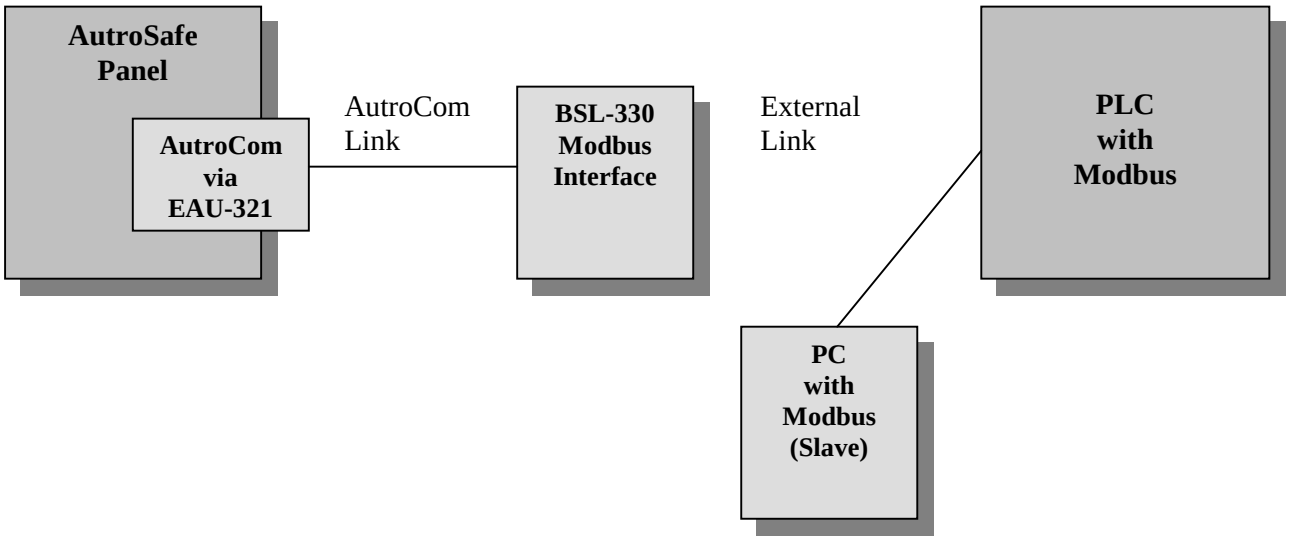
12.4 Testing Modbus output from BSL-330



It's possible to test the BSL-330 without having a working PLC.

- Connect a PC to BSL-330 port 2
- Run the Mdbus.exe program.
- Open the serial port with correct settings:

12.5 Testing Modbus input to PLC



It is possible to test the PLC stand-alone.
This is very useful to verify the baud-rate etc. (when communication problems), and that the register numbering of the PLCs is correct (when functional problems).

The Mdbus.exe program is a third party test tool which must be purchased separately (from www.calta.com).

- Connect a PC to the Third party Modbus compatible equipment / PLC equipment
- Run the Mdbus.exe program.
- Open the serial port with correct settings

13. BSL-330-Configuration Tables

13.1.1 The Settings table

The Settings table has only one line. Note that [1] is used in the brackets for all settings (Settings[1]) in the Settings Table (see table below).

```
Settings[1]; SlaveAddress=1;
Settings[1]; AcceptFaults=F;      // T=(true)Automatic accept, F=(false)No accept
Settings[1]; CmdHandshake=T;      // T=(true)Command READY bit, F=(false)None
Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always
Settings[1]; PollTime=300
```

All parameters omitted in the configuration file will be set to default values.

Field	(Example) Values	Explanation
SlaveAddress	1	BSL-330-1 Slave: This is the Slaves's address. The PLC Master will send messages to this address on the RTU bus. BSL-330-2 Master: The Master is designed to communicate with only one slave, the address entered here. Value range is 1 to 247. *Default value*: 1.
SlaveId	11	BSL-330-1 Slave only: This value will be returned from the Slave if the PLC Master uses function 17 Report Slave Id. Normally not used. Value range is 10 to 247. (The BS-100 Modbus units have SlaveId 10) *Default value*: 11
PollTime	300	BSL-330-1 Slave: To detect an incoming command from the PLC, the slave must inspect the Command register periodically. This time is set here. Commands should be sampled several times per second – reduced sampling gives slower, unpredictable command response. Value range is 100 to 65000 (milliseconds). *Default value*: 300.
AcceptFaults	F	The BSL-330-x can be used in systems where the AutroSafe is being used as a "big loop controller", and the user interface is a PLC. In this case the BSL-330 can be configured to accept faults automatically. Only "hard" faults will remain and be shown on the PLC screen. This setting is normally turned off in regular AutroSafe configurations using AutroSafe Operator Panels. Values are F for "False" or T for "True". *Default value*: F. For further details, see chapter 14.3.6.

Field	(Example) Values	Explanation
CmdHandshake	T	The BSL-330-x uses a simple register for commands from the PLC to the AutroSafe. It's possible to implement a "reliable" procedure using handshake bits. See separate description. BSL-330-1 Slave: The Slave can acknowledge a command simply by zeroing the Command register (it's read/write). Set CmdHandshake = F. Values are F for "False" or T for "True". *Default value*: T. "The Slave can acknowledge a command simply by zeroing the Command register" endres til: "When set to False, a simple handshake is performed by the Slave, it acknowledges a command simply by zeroing the Command register" For further details, see chapter 14.3.
P2Baud	9600	Baud rate for Port 2, the Modbus port. 3) The recommended baud rates are 9600 or 19200, as a compromise between acceptable transfer speed of tables and system CPU load. Values are 4800, 9600, 19200, 38400. *Default value*: 9600. (If P2Baud = 0; the KD-485's port 2 can be set using KDCFG.EXE)
P2Parity	N	Parity for Port 2 1) Values are N "none", O "odd", E "even". *Default value*: N.
P2Stop	1	Stop bits for Port 2 2) Values are 1 or 2. *Default value*: 1.
OldFPEs	F	Backward compatibility setting for Digital Inputs (FPEs). *New in BSL-330 v 3.4* Set to "T" (true) if an existing PLC is upgraded from AutroSafe 3.3 to 3.4 or newer. *Default value*: F
NoPollFault	10	BSL-330-1 Slave: *New in BSL-330 v 3.4.1* A communication fault is reported on the AutroSafe panel if the PLC does not read any Input register within the time (PollTime * NoPollFault) milliseconds. 0 = no fault report. *Default value*: 10, corresponding to 3 seconds.
CommFault	T	This flag controls reporting of communication problems *New in BSL-330 v 3.4.1* between the BSL-330 and the PLC. When set to "T" (true), faults are reported on the AutroSafe panel display. When set to "F" (false), the PLC must report faults. Values are F for "False" or T for "True". *Default value*: T.

1) The unit sends with correct parity, but is unable to verify when received.
2) Only 1 parity bit is sent.
3) If not supported baud rates are set, the previous baud rates will be used. No error message will be reported.

13.1.2 The Statuses table

The BSL-330-x has a big table in its RAM ("register bank") where various AutroSafe statuses are collected.
The Config Statuses table describes:

- How this RAM table is partitioned in sub-tables (one sub-table per Unit Type)
- The Modbus Register numbers seen from the PLC (first Register for each Unit Type table)

```
// Table of AutroSafe status registers
//-------------------------------------
Statuses[1]; Name=AutroSafe; Type=As; Register=30001; NoOfRegs=1;
Statuses[2]; Name=WatchDog ; Type=Wd; Register=30002; NoOfRegs=1;
Statuses[3]; Name=Points   ; Type=PT; Register=30003; FirstUnitNo=1; LastUnitNo=512;
Statuses[4]; Name=Inputs   ; Type=FP; Register=30501; FirstUnitNo=1; LastUnitNo=200;
Statuses[5]; Name=Sounders ; Type=FD; Register=30601; FirstUnitNo=1; LastUnitNo=100;
```

Field	(Example) Values	Explanation
`Name`	`AutroSafe`	Comment text only. *Default value*: <none>.
`Type`	`As`	Each sub-table holds information related to one Unit Type in AutroSafe, for example Points or FPEs. The "Type" field must be set to the *two-character code* used in the AutroCom protocol. The most interesting Units to monitor are (note UPPERCASE): `PT` – Detector Points `FP` – Fire Protection Equipment, that is, digital I/O units `FD` – Fire Alarm Devices, that is, bells and sounders `PW` – Powers `DL` – Detector Loops (other codes can be found in AutroCom protocol documentation) To make the register layout uniform, some information generated internally by BSL-330-x is defined in a similar manner. In this case the "Type" code is a mix of upper and lower case characters, which will never come from AutroSafe: `As` – AutroSafe status (see separate description) `Wd` – Watchdog counter (see separate description) *Default value*: <none>
`Register`	`40001`	The Modbus Register in "PLC format". BSL-330-1 Slave: The Status register block is "Input Registers", always starting at 30001, max. 32095. BSL-330-2 Master: The Status register block is "Holding Registers". Here the first register can start at any value within the 10 000 registers numbered from 40001, and occupying max 2095 registers. *Default value*: <none>. Register numbers must be *ascending* from sub-table to sub-table!
`NoOfRegs`	`1`	This is one alternative for the description of a sub-table's size. The "system statuses" are register-wide, and then "NoOfRegs" just defines how many 16-bit registers are required for this sub-table. Note: If NoOfRegs have a value > 0, this setting has priority over xUnitNo settings described below! *Default value*: 0.

Field	(Example) Values	Explanation
`FirstUnitNo` `LastUnitNo`	`1` `512`	This is another alternative for the description of a sub-table's size. AutroSafe "unit status" are 8-bit, so each 16-bit Modbus register hold data for 2 Units. `FirstUnitNo` is usually 1. It's possible to set this value higher, and then status for UnitNos on lower numbers will be ignored. (Note that previous Modbus softwares hard-coded its status table starting with UnitNo 0). `LastUnitNo` must be set to the highest UnitNo used for the UnitType in this sub-table. This number can be found from AutroSafe Config. See separate description of UnitIds. Status for UnitNos higher than LastUnitNo will be ignored. *Default value*: 0.

13.1.3 The Commands table

The BSL-330-x has table in its RAM ("register bank") where commands from the PLC to AutroSafe are collected. The Commands table has only one sub-table in this software version.
The Commands table is similar to the Statuses table. See that for field details. Below you will find only information that is unique for the Commands table.

```
// Table of AutroSafe command registers
//-------------------------------------
Commands[1]; Name=Commands ; Type=Cm; Register=40001; NoOfRegs=3;
```

Field	(Example) Values	Explanation
`Type`	`Cm`	The only sub-table is: `Cm` – Command Registers (see separate description) *Default value*: <none>
`Register`	`40001`	The Modbus Register in "PLC format". BSL-330-1 Slave: The Command register block is "Holding Registers", always starting at 40001, max. 40003. BSL-330-2 Master: The Status register block is "Holding Registers". Here the first register can start at any value within the 10 000 registers numbered from 40001. Honeywell's Slave PLC has read-only registers starting from 45001, so this is the recommended value. *Default value*: <none>
`NoOfRegs`	`3`	The Command register block is 3 registers. *Default value*: 0.

13.2 Configuring the Status Table

The status table, which holds 2095 registers, can be divided into sub-tables by Configuration. The table is accessed via Modbus as Input Registers (Slave) or Holding Registers (Master). The table is referenced the usual PLC way, using indexes in the range 30001-32096 (Inputs) or 40001-42096 (Holding).
Each sub-table is described by:

- Register start address.
  Typical values will be 30001 (Slave) or 40001 (Master), but on the Master it's possible to set a higher address like 41001 if several AutroSafes are connected to one PLC.
- First Unit No.
  This is the UnitId found in AutroSafe Config. Normally it will be 0 (which is never used, but previous Modbus softwares included 0), or 1. It's possible to use several Modbus interfaces on one AutroSafe, and in this case the second Modbus should be configured with FirstUnitNo = 513 (depending on the total number of detectors in AutroSafe).
- Last Unit No.
  The highest UnitId monitored by this Modbus interface. For a Slave, just set it to a high enough value. For a Master, set it as correct as possible (or slightly higher), as it defines the size of the data messages sent.
- No Of Regs
  Some system tables are simply dimensioned by giving the number of registers.
  If NoOfRegs is given, first/LastUnitNo will be ignored.

When several sub-tables are set up, you have to calculate the start address for each of them in turn. (These addresses will be needed for the PLC programming). You can fill the table completely, or you can select to have “holes” between tables. PLC programming is difficult to change later, so you should set up the detector point table with some spare registers at the end for future expansion of the fire alarm system.

Regarding calculation of sub-table size:
Remember that the Start Register Address is a 16-bit register index, while the First/Last-UnitNo represents 8-bit values, 2 within each register. So if you have a table starting at 40101, and have FirstUnitNo=0 and LastUnitNo=100, the calculation goes like this:
You have 101 bytes (remember 0 counts…), which will occupy 51 registers.

Next table can start at 40101 + 51 = 40152.
The example below shows the next table with FirstUnitNo=513.

Reg. No	**Register Contents**	
40001	16-bit system register …	
40002	16-bit system register …	
40003	8-bit statuses…	
…		
40101	UnitNo **0**	UnitNo 1
40102	UnitNo 2	UnitNo 3
…	…	…
40151	UnitNo **100**	<unused>
40152	UnitNo **513**	UnitNo 514
40153	UnitNo 515	UnitNo **516**

13.3 Config file examples

13.3.1 BSL-330/1 Modbus Slave Config

```
//
// Config file for BSL-330 Modbus Slave
//--------------------------------------
//
// General settings
//-----------------
Settings[1]; SlaveAddress=1;
Settings[1]; AcceptFaults=F;      // T=(true)Automatic accept, F=(false)No accept
Settings[1]; CmdHandshake=T;      // T=(true)Command READY bit, F=(false)None
Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always
//
//
// Table of AutroSafe status registers
//-------------------------------------
Statuses[1]; Name=AutroSafe; Type=As; Register=30001; NoOfRegs=1;
Statuses[2]; Name=WatchDog ; Type=Wd; Register=30002; NoOfRegs=1;
Statuses[3]; Name=Points   ; Type=PT; Register=30003; FirstUnitNo=1; LastUnitNo=512;
Statuses[4]; Name=Inputs   ; Type=FP; Register=30501; FirstUnitNo=1; LastUnitNo=200;
Statuses[5]; Name=Sounders ; Type=FD; Register=30601; FirstUnitNo=1; LastUnitNo=100;
//
// Table of AutroSafe command registers
//--------------------------------------
Commands[1]; Name=Commands ; Type=Cm; Register=40001; NoOfRegs=3;
```

13.3.2 BSL-330/2 Modbus Master Config

The main difference from a Slave Config is the use of Registers only in the 4xxxx range, and the Command register is assigned to a high address.

```
//
// Config file for BSL-330-1 Modbus Master
//--------------------------------------
//
// General settings
//-----------------
Settings[1]; SlaveAddress=1;
Settings[1]; AcceptFaults=F;      // T=(true)Automatic accept, F=(false)No accept
Settings[1]; CmdHandshake=T;      // T=(true)Command READY bit, F=(false)None
Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always
//
// Table of AutroSafe status registers
//-------------------------------------
Statuses[1]; Name=AutroSafe; Type=As; Register=40001; NoOfRegs=1;
Statuses[2]; Name=WatchDog ; Type=Wd; Register=40002; NoOfRegs=1;
Statuses[3]; Name=Points   ; Type=PT; Register=40003; FirstUnitNo=1; LastUnitNo=512;
Statuses[4]; Name=Inputs   ; Type=FP; Register=40501; FirstUnitNo=1; LastUnitNo=200;
Statuses[5]; Name=Sounders ; Type=FD; Register=40601; FirstUnitNo=1; LastUnitNo=100;
//
// Table of AutroSafe command registers
//--------------------------------------
Commands[1]; Name=Commands ; Type=Cm; Register=44001; NoOfRegs=3;
```

13.3.3 Backward compatibility: BSL-330 Modbus Slave Config

It is possible to configure the “new” slave identical to the Slaves of versions 1.0 and 3.0.

The important values are **bolded** below. Note that there is an unused register area from 2 to 47. Also note that FirstUnitNo is ZERO. The SlaveAddress was configurable via the KDCFG.EXE program.
The new Slave unit accepts access only for the registers actually in use (the old one accepted read of > 4000 registers). If this becomes a problem for an upgrade, just increase LastUnitNo so that it’s at least 128 registers larger than the highest UnitNo (The PLC Master may read by using largest possible Modbus data messages, which are 256 bytes long or 127 registers).

```
//
// Config file for BSL-330 “old” Modbus Slave
//-----------------------------------------
//
// General settings
//-----------------
Settings[1]; SlaveAddress=1;
Settings[1]; AcceptFaults=T;      // T=(true)Automatic accept, F=(false)No accept
Settings[1]; CmdHandshake=F;      // T=(true)Command READY bit, F=(false)None
Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always
//
// Table of AutroSafe status registers
//------------------------------------
Statuses[1]; Name=AutroSafe; Type=As; Register=30001; NoOfRegs=1;
Statuses[2]; Name=Points   ; Type=PT; Register=30048; FirstUnitNo=0; LastUnitNo=4095;
//
// Table of AutroSafe command registers
//-------------------------------------
Commands[1]; Name=Commands ; Type=Cm; Register=40001; NoOfRegs=3;
```

13.3.4 Backward compatibility: BSL-330 Modbus Master Config

It is possible to configure the "new" Master identical to the Master of version 3.0.

Note that the first Status register is Watchdog!
The "old" Master had *configurable* "write offset" and "read offset", corresponding to the
`Statuses[1]; Register=` and `Commands[1]; Register=`
settings. It also had configurable MaxNoOfPoints, corresponding to `Statuses[3]; LastUnitNo=` 512 in the example here. Finally, the SlaveAddress was configurable.

```
//
// Config file for BSL-330 "old" Modbus Master
//-------------------------------------------
//
// General settings
//-----------------
Settings[1]; SlaveAddress=1;
Settings[1]; AcceptFaults=T;      // T=(true)Automatic accept, F=(false)No accept
Settings[1]; CmdHandshake=F;      // T=(true)Command READY bit, F=(false)None
Settings[1]; P2Baud=9600; P2Parity=N; P2Stop=1; //RTU requires 8-bit word always
//
// Table of AutroSafe status registers
//------------------------------------
Statuses[1]; Name=WatchDog ; Type=Wd; Register=40001; NoOfRegs=1;
Statuses[2]; Name=AutroSafe; Type=As; Register=40002; NoOfRegs=1;
Statuses[3]; Name=Points   ; Type=PT; Register=40005; FirstUnitNo=0; LastUnitNo=512;
//
// Table of AutroSafe command registers
//-------------------------------------
Commands[1]; Name=Commands ; Type=Cm; Register=45001; NoOfRegs=3;
```

13.4 DIGITAL I/O

AutroSafe has no inputs called "Digital I/O". But it's possible to use Fire Protection Equipment units in the BN320/x product range, as they have an input monitoring capability. As long as a FPE is not "Activated" by AutroSafe, the input can change without any nasty side effects (Activated units have timeouts on the monitoring inputs causing AutroSafe FAULTs!).
Digital I/O units can be used to:

- Report status of units controlled by AutroSafe, e.g. fans starting or fire doors closing.
  Any BN-320/x can be monitored.
- Report status of units used only as inputs.
  BN-320/4 "Standard Control Unit" will be the best choice here.
  Note also that BN-320/4 has a second input, which can be used go generate FAULTS related to the connected equipment.
- Outputs controlled by the PLC.
  Any BN-320/x can be controlled. All BN-320s use identical hardware, but there is differences regarding how the inputs are used, and timeouts from an output is *activated* to an input reports successful *operation*.

As the BN-320/x units are loop units, they are not allowed to generate many events in a short time (signaling capacity is approximately 4 operations per second).

13.5 FPEs in AutroSafe Config

Regular FPEs are ADD'ed to a loop, then assigned an "Activation Group" in AutroSafe Config. This is described in standard AutroSafe documentation.

"Input only" FPEs that are to be used as pure "Technical Alarms" must also be ADD'ed to a loop, but **shall have no "Activation Group"**. You will get a warning when generating the Config, which you can ignore (this capability is by design).

Note that the BN320/x units have "input filtering". A change of the input's state is reported after a configurable time. If the input returns to its previous state within this time, nothing is reported. This time is called **"Normal Monitoring Timer"** in BN-320/4 (it's the first of 3 timer settings for all of them). In addition to the configurable time, the unit's software adds 2 seconds "minimum filter" time.

14. Configuring the Modbus

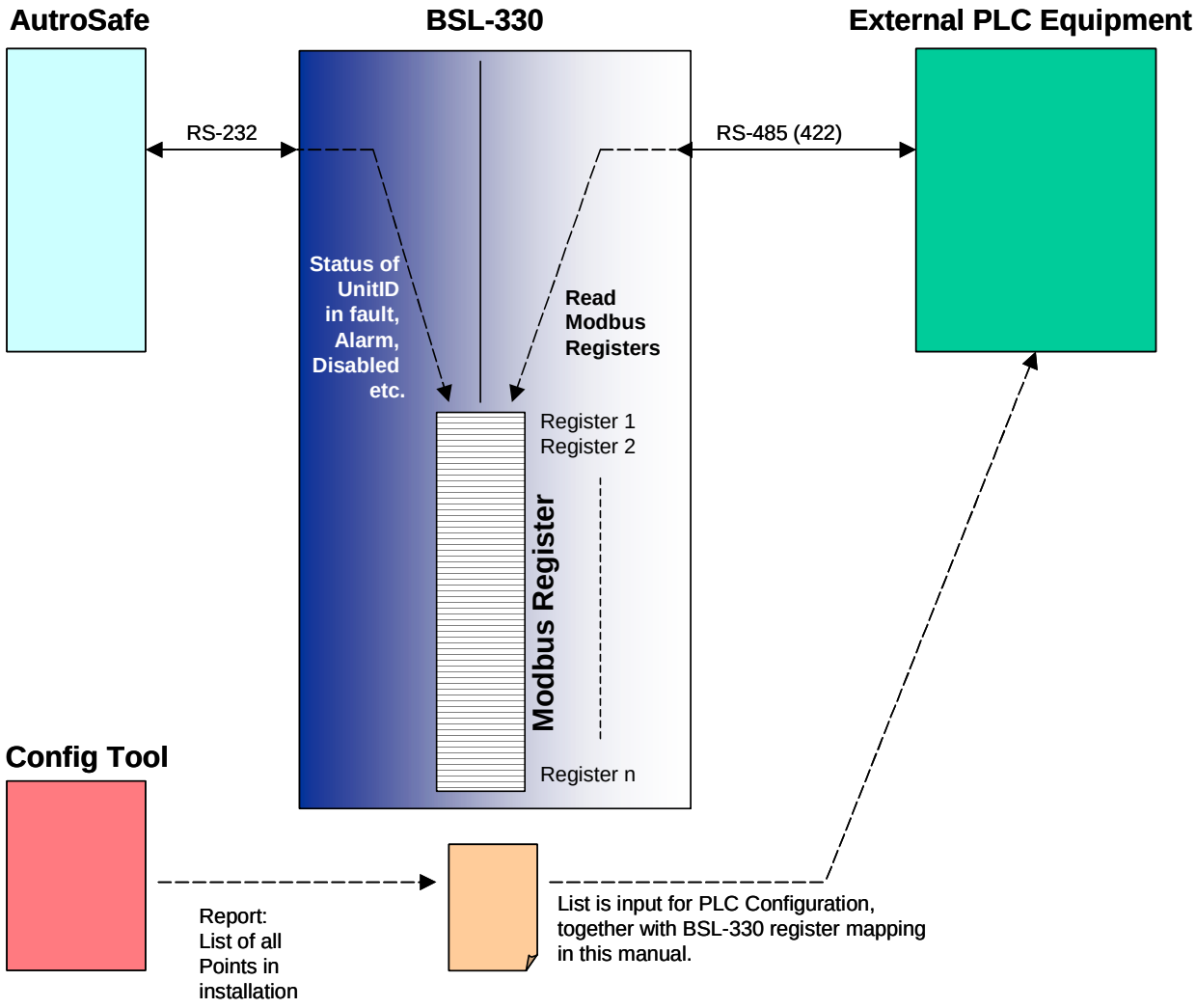
14.1 Overview

The site-specific AutroSafe configuration data and the BSL-330 register mapping (Modbus register, see *Modbus Register Mapping*) are used as input for the configuration of the external PLC equipment.

The BSL-330 Converter reads all status messages from AutroSafe on a protocol called AutroCom, and keeps the accumulated results in a list of registers internally.

These registers are transferred to the PLC by means of the Modbus protocol. The one used here is the **Modbus RTU** protocol over an RS-422/485 or RS-232 link.

The illustration below gives an overview of the data communication.



14.2 How to Use the AutroSafe Data and Registers

14.2.1 Communication

The Modbus and AutroCom communications are performed independently. This means that the Modbus communication to the BSL-330 Converter does not lead to a corresponding message to the AutroSafe. The BSL-330 Converter continuously monitors the Modbus port and responds using the data available on the BSL-330 Converter. The BSL-330 Converter monitors the AutroCom line independently of any Modbus activity, and if there is a command to be sent, it does so, using flags.

As can be seen from the illustration on the previous page, AutroSafe status is written to the register file in BSL-330 by BSL-330 itself. This list of register is then at regular intervals transferred to the external Modbus device.

The BSL-330 Slave variant is passively responding to the external Modbus Master. There may be several Slaves in such a Modbus network.
The BSL-330 Master variant polls the Modbus device in the network for data, and writes the registers of AutroSafe information to the external part (which must be slave). The BSL-330 Master allows only one Slave to write to.

14.3 Modbus handshake

To obtain a secure mechanism for sequential commands from the Modbus side to the BSL-330, a handshake mechanism is required. For backwards compatibility this may be switched off by setting the parameter Cmd Handshake to OFF. Default is ON.

BSL-330 in turn sets the flag READY in the System Status Register to indicate that the command is in progress. READY is defined as active when cleared (active low).

The handshake mechanism becomes essential when multiple commands like many disablements, inhibits or FPE commands are sent from the PLC.

14.3.1 Modbus handshake Enabled (Master and Slave)

When the handshake is enabled, the sequence is:

1. READY is cleared in the System Status Register. The Command Register is cleared.
2. The PLC verifies that the READY flag is cleared. It then sets the Command Register for the actual command.
3. BSL-330 recognises the change of the Command Register, and sends the Command to AutroSafe. Then BSL-330 sets the READY flag to indicate the command has been read, and is in progress.
4. The PLC awaits the READY flag to be set, and then clears the Command Register.
5. BSL-330 awaits the Command Register to be cleared, then clears the READY flag to indicate it is ready for the next command. This is the initial state.

Fault handling in case of lost communication or deadlocks must bring both ends to the above state 1 after a communication break or timeout of 10 seconds.

14.3.2 Modbus handshake Disabled, Master

When the handshake is disabled, the sequence is based on an interval of at least 1 second between each subsequent change of the Command Register:

1. READY is cleared in the System Status Register. The Command Register is undefined.
2. The PLC doesn't care about the READY flag. It changes the Command Register for the actual command. If this is the same as the previous command, it is required to set the Command Register to zero for at least 1 second prior to setting the next command.
3. BSL-330 recognises the change of the Command Register, and the command is sent to AutroSafe. The BSL-330 must fulfil this within the interval of 1 second between each command.

14.3.3 Modbus handshake Disabled, Slave

When the handshake is disabled, it is necessary to keep an interval of at least 1 second between each subsequent change of the Command Register: As the BSL-330 Slave can both read and write the register, and the previous version of BSL-330 actually cleared the Command Register, this is for backwards compatibility.

1. READY is cleared in the System Status Register. The Command Register is cleared.
2. The PLC doesn't care about the READY flag. It sets the Command Register for the actual command.
3. BSL-330 recognises the change of the Command Register, and sends the Command to AutroSafe. It then clears the Command Register.

14.3.4 Interpreting and Handling Information in the List

Interpreting this list is the clue when setting up the external connection to BSL-330 Converter. The register definition is defined by the tables in the next section of this handbook (*Modbus Register Mapping)* . However, some of these registers are directly dependent on the actual AutroSafe configuration.

In AutroSafe, each detector is labeled by a *Unit Name* and a corresponding *Unit ID*. The Unit ID is the index in the register file.

The AutroSafe configuration data for the site installation must be available in a report, including the detector identification, (either by point no/loop no, the tag name, the serial no or similar) and the UnitID. The UnitID of the detector is the index in the list of registers.
See example below:

```
OZ1, Operation Zone
AZ1, Alarm Zone
lc1, BS-320 CPU EAC Log Controller
DO1, Domain Network
do1, BS-320 CPU EAC Domain Controller
BQ1, BS-320 CPU EAC BLC-Eq
DL1, BS-320 BSL 310
CO1, BS-320 CPU EAC
PW1, BS-320 Power
bc1, BS-320 CPU EAC BLC Controller
co1, BS-320 CPU EAC Computer Controller
OP1, BS-320 CPU BSR Operator Panel Equi
CO2, BS-320 CPU BSR
co2, BS-320 CPU BSR Computer Controller
DL2, BSD 310
DL3, BSB 310
PT1, A0101
PT2, A0102
PT3, A0103
FD1, A0104
PT4, A0105
FP1, Dig Outp
FD2, Bell
AC2, Modbus BSL-330/1
OP2, OP AutroCom
DZ1, Canteen
DZ2, Sales Office
DZ3, Corridor South
AZ2, Alarm Zone 1
AZ3, Alarm Zone 2
dl1, BS-320 CPU EAC Loop Controller
pt1, BS-320 CPU EAC Point Controller
fd1, BS-320 CPU EAC FAD Controller
fp1, BS-320 CPU EAC FPE Controller
pw1, BS-320 CPU EAC Power Controller
op1, BS-320 CPU EAC OP Controller
oz1, BS-320 CPU EAC OZ Controller
dz1, BS-320 CPU EAC DZ Controller
az1, BS-320 CPU EAC AZ Controller
FA2, Fare
FW3, FWRE (Fault Warning Rout
```

A typical AutroSafe Configuration file includes the following information (from "UnitName.txt):

0x0001 L1-Heat
0x0002 L1-MCP
0x0003 L1-Multi
0x0004 L1-Opt

The detector "L1-Opt" is then found in the third Detector Register, MSB.

Note that the sequence of detectors may be non-contiguous, leaving some few SystemIDs unused. This is controlled by the AutroSafe Configuration Tool.

14.3.5 Modbus Slave Address

The Modbus Slave address of the BSL-330 Converter is set during the configuration of the BSL-330 Converter. This parameter defines the BSL-330/1 or /3 Slave's address to respond to, and on the BSL-330/2 or /4 Master which Slave address it will read from on the Modbus. It can not be changed on-line.

14.3.6 Fault Handling

AutroSafe defines several conditions of a fault. At first, when a fault is detected, it is presented on the panel and to the BSL-330 as a fault, condition is "Not accepted". The fault then needs to be accepted, else it will remain as a fault even if the source of the problem is repaired. (See AutroSafe manuals for detailed explanation.)
It must be defined who's responsible for the acceptance of faults. Normally this is by the operator, but it is possible to let the BSL-330 automatically grant the fault receival by setting the parameter *AcceptFault*

`AcceptFault=T;`
At receipt of a fault from AutroSafe, the BSL-330 responds with an Acknowledge to this fault. AutroSafe in turn replies either with a "FAULT OK" (the fault was intermittent), or with "FAULT ACCEPTED". In the latter case, the BSL-330 asserts the fault flag for the related device in the register. This will reflect the fault condition of AutroSafe. The fault will then appear as accepted on the AutroSafe panel, the flashing indicator will go steady, and the buzzer will be turned off. Possible intermittent faults will be cleared by this method (assuming they go to OK status short after, and do not need Reset to be cleared).

`AcceptFault=F;`
At receipt of a fault from AutroSafe, the BSL-330 asserts the flag of the corresponding register. The fault is then implicitly accepted if the operator (via Modbus) commands a Reset. Or, the fault may be accepted by an operation at the AutroSafe panel. The fault may be cleared at this operation, if so, BSL-330 clears the fault flag.

14.4 Modbus Register Mapping

This section deals with the Modbus 3x and 4x series register map used by the AutroSafe. Addressing begins with 0. The counting of these registers is assumed to start from 1, though the Modbus communications register value starts from 0. Care should be exercised to ensure that the communications address and the general address are not confused.

14.4.1 Register Allocation Summary

All the data in the BSL-330 Converter is related to the storing of AutoSafe Information in Modbus registers. The structure, its Modbus mapping and the AutroSafe information that is stored is summarized as follows:

From PLC to BSL-330:

KD485 structure element	MODBUS MASTER	MODBUS SLAVE	AutroSafe Information Stored
Command	Holding Register 0	Holding Register 1	Command Register
Time	Holding Register 1	Holding Register 2	MS Time Register
Time	Holding Register 2	Holding Register 3	LS Time Register

From BLS-330 to PLC:

KD485 structure element	MODBUS MASTER	MODBUS SLAVE	AutroSafe Information Stored
watchdog	Holding Register 0	Not used	Master: Watchdog counter
f_d_status	Holding Register 1 MSB	Input Register 1 MSB	General fault/disablement indicator
system_status	Holding Register 1 LSB	Input Register 1 LSB	BSL-330 Status Register
detector_status[4095]	Holding Registers 2+offs	Input Registers 2+offs	Detector information
FPE_status [511]	Holding Registers 2+offs	Input Registers 2+offs	FPE information
FAD_status [511]	Holding Registers 2+offs	Input Registers 2+offs	FAD information

14.4.2 System Status Register (Holding/Input Register 1)

This register indicates the status of the BSL-330 Converter and the AutroSafe system. The status is updated and available to the Modbus device even when the AutroSafe is unavailable.

Register Contents LSB	Status Indication
0x00	Watchdog Error (Master only) – Internal failure, or Checksum failure., Assumes the PLC registers are set to 00 initially, if BSL-330 fails to answer.
0x01	System Functioning Normally BSL-330 has established connection to AutroSafe and all AutroSafe status are updated. Only in this state the set of data is valid.
0x02	System Starting Up Starting up" Connection is established to AutroSafe, and a request to get all status from AutroSafe is sent, but not yet fulfilled. Note that this status is also shown in the interval where the panel performs a loop disable / enable, an Init and a Reset, as the correct status is defined and reported from AutroSafe to BSL-330 at the end of these.
0x03	Communications Error to AutroSafe Communication between AutroSafe and BSL-330 is lost.
0x04	System Down When BSL-330 starts up (due to a power break or by pushing the Reset button), if there's no answer from AutroSafe.
Register Contents MSB	**Status Indication**
Bit 0x01 set	Disablements exist in the system
Bit 0x02 set	Faults exist in the system
Bit 0x10 set	Ready – BSL-330 is ready to receive a new command when cleared

14.4.3 Detector Information (Holding / Input Registers 2 to 4096)

Each AutroSafe input is mapped by the BSL-330 Converter to half a Modbus Register (8 bits). That is, two detectors share the two bytes of the same Modbus Register, as follows:

Detector	Modbus Holding Register (Master) / Modbus Input Register (Slave)	
0	Base +DEToffs	MSB
1	Base +DEToffs	LSB
2	Base +DEToffs+1	MSB
3	Base +DEToffs+1	LSB
.....	.....	.....
4094	Base +DEToffs+2047	MSB
4095	Base +DEToffs+2047	LSB

The format of each of the input register data is as follows:

Bit	Meaning when set
bit 0	Alarm/High Gas Alarm
bit 1	Pre-Warning/Early Warning/Low Gas Alarm
bit 2	Fault
bit 3	Disabled
bit 4	Inhibit
bit 5	Not used
bit 6	Not used
bit 7	Not used

14.5 FPE Information

Each AutroSafe FPE is mapped by the KD485 to half (8 bits) a Modbus Register. That is, two FPEs share the two bytes of the same Modbus register, as follows:

FPE	Modbus Holding Register (Master) / Modbus Input Register (Slave)	
0	Base+FPEoffs	MSB
1	Base+FPEoffs	LSB
2	Base+FPEoffs+1	MSB
3	Base+FPEoffs+1	LSB
.....	.....	.....
510	Base+FPEoffs+255	MSB
511	Base+FPEoffs+255	LSB

For backwards compatibility, the FPE Offset register also defines the Max no of detectors.

The format of each of the register data is as follows:

Bit	Value	Meaning when set
bit 0	0x01	Activation State (inside AutroSafe)
bit 1	0x02	Activation State (inside AutroSafe)
bit 2	0x04	Fault
bit 3	0x08	Disabled
bit 4	0x10	Operation State (inside FPE unit)
bit 5	0x20	Operation State (inside FPE unit)
bit 6	0x40	Equipment State (read from input)
bit 7	0x80	Equipment State (read from input)

The *Activation State* and *Operation State* are defined as follows:

Bit 5/1, 4/0	Interpretation
00	Off
01	On
1x	Fault current state or Illegal activation state (typically caused by problem duing system initialization

NOTE:
Operation state's functionality changed from AutroSafe 3.4.1and BSL-3.4.0. Previously it reflected the inputs (actual output state), while now it shows the unit's output state (relay drive).

The *Equipment State* is defined as follows:
(new from BSL-330 version 3.4)

Bits 7, 6	**Inter-pretation**	**Unit type**
00	Off	BN-320/3 Low Location Lights BN-320/4 Monitoring and Control Unit
01	On	
00	Door Open	BN-320/2 Door Control unit Note: *Door Closed* can be used as a single bit.
01	Door Closed	
10	Door in transition	
00	Ready	BN-221/1 Extinguishing Control Unit (“Halon”) Note: *Released* and *Override* can be considered independent bits
01	Released	
10	Override	
11	Override Released	

14.5.1 Command Register (Read/Write Holding Register 1)

This register is used to pass commands to the AutroSafe. The commands available are as follows :

Master Register Contents	Slave Register Contents	Command
0x1000	0x1000	Silence Bell
0x2000	0x2000	Reset
0x2100	0x2100	Initialise AutroSafe
0x3000	0x3000	Set System Time/Date - Note 1)
0x4000 + detector number	0x4000 + detector number	Detector Disable
0x5000 + detector number	0x5000 + detector number	Detector enable
0x6000 + detector number	0x6000 + detector number	Detector Inhibit
0x7000 + detector number	0x7000 + detector number	Detector Cancel Inhibit
0x8000 + detector number	0x8000 + detector number	(0x8000 is kept for backward compatibility)
0xE000 + FPE number	0xE000 + FPE number	FPE Activate – Note 2)
0xE200 + FPE number	0xE200 + FPE number	FPE Deactivate
0xE400 + FPE number	0xE400 + FPE number	FPE Disable
0xE600 + FPE number	0xE600 + FPE number	FPE Enable

Notes:
Register 1, 2 and 3 will be read simultaneously by BSL-330 to ensure that additional parameters (like date and time) are correctly received.

Note 1
Writing of time and date information must be done by two separate commands, the first to write to holding registers with the time and date information and then writing to the command register.
Read System Time is not implemented.

Note 2
It's not possible to activate/de-activate a Disabled FPE. This should be checked in the PLC's user interface.

Limited range for UnitId (detector and FPE number)
Detector or FPE number is calculated from the UnitID of this device minus the offset. If the UnitID exceeds MaxNumber, or the UnitID minus offset is <0, the command is discarded with no warning.

To address units > MaxNumber, set Holding Register 2 to the UnitID, and set the detector or FPE number to zero in the Command Register when issuing the command.

14.5.2 Date & Time Register (Read/Write Holding Registers 2 & 3)

These two registers simply store the Unix time to be transferred, that is, seconds since Jan 1 1970, 00:00.

Note that Holding Register 1 needs to be zero when writing to register 2 and 3.

Register 2 is the Most significant half of the 32 bit value.

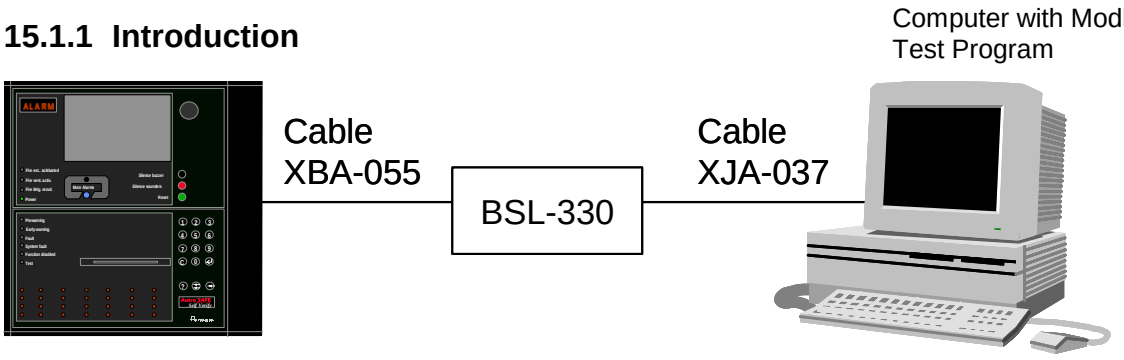
These two registers simply store the Unix time (UTC) to be transferred. Register 2 is the most significant half of the 32 bit value, Register 3 the least significant.

Example: Jan 1 2000 at 00:00 is 30 years of 365 days plus 7 leap years, that is 946 684 800 seconds. The MSW Register then takes the integer division by 2^{16}, and the LSW register the division of modulo2^{16}, that is 946 684 800/65536 = 14445 (register 2) plus rest 17280 (register 3).

15. Appendix

15.1 Verifying the Communication between AutroSafe and the BSL-330 Converter using default configurations

15.1.1 Introduction



Before customizing the configuration of the BSL Module, it is possible to verify that the cabling and communication beetween AutroSafe and the BSL-330 module is successful so that BSL-330 operates correctly with AutroSafe.

The verification procedure is based on the default configuration of the BSL-330 Module, which is downloaded at the factory and supplied on the CD (AS-MODBUSCD. The procedure requires a computer and the Modbus Test Program (page 8).

15.1.2 Default Configurations – Modbus Master / Modbus Slave

The CD has two default configurations for BSL-330 Converter:

- Configuration for Modbus Master (BSL-330 MasterConfig.txt)
- Configuration for Modbus Slave (BSL-330 SlaveConfig.txt)

Note that the computer must be configured as Slave if the BSL-330 is a Modbus Master, and as Master if the BSL-330 is a Modbus Slave.

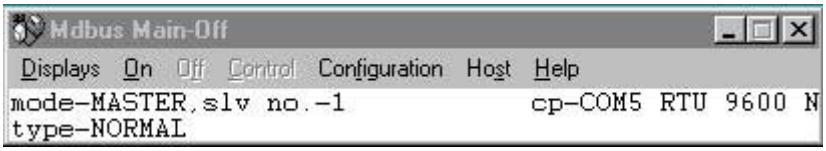
15.1.3 Preparations - AutroSafe Configuration

Note that the AutroSafe system must be configured according to the specific installation. Furthermore, the AutroCom type for the serial port must be set to Sliding Window. Refer to chapter 7.

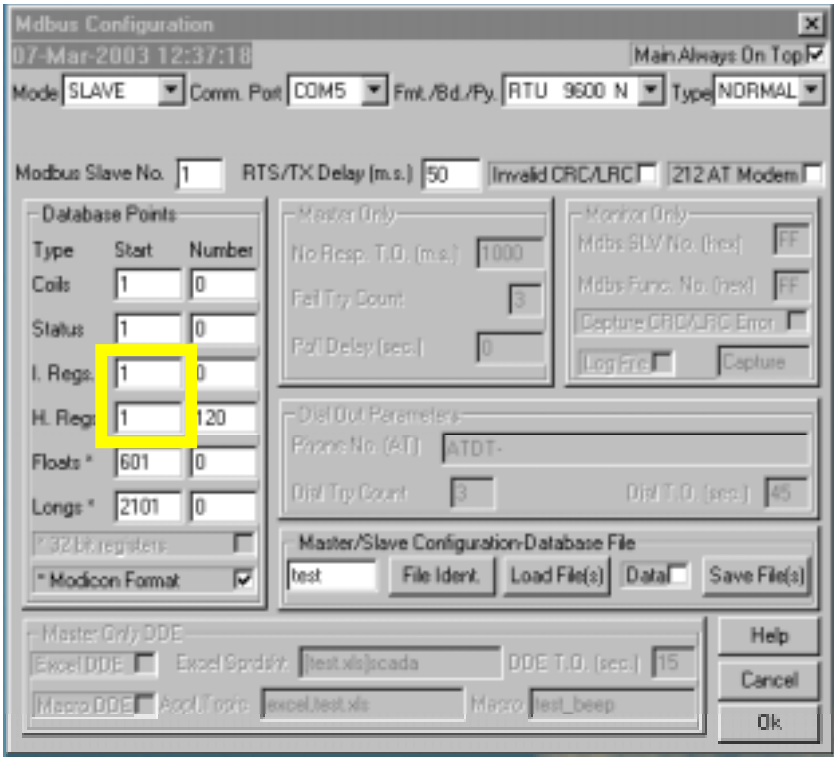
15.1.4 Verification Procedure – Modbus Master

Note that the computer must be configured as Slave if the BSL-330 is a Modbus *Master*.

- Do the necessary cable connections (cables XBA-055 and XJA-037) between the computer, BSL-330 Module and the AutroSafe. Consult the drawing on the previous page.
- Switch the BSL-330 ON.
  The communication between BSL-330 and AutroSafe will start immediately. The Leds TX and RX for port 1 on the Modbus Converter will both blink.
- To start the Modbus Test Program on the computer, click the mdbus.exe icon.



- To start the communication between the computer and the Modbus, click **On** (the top level menu shown above).
- Select the correct Communication Port (COM5 is used in the example below).



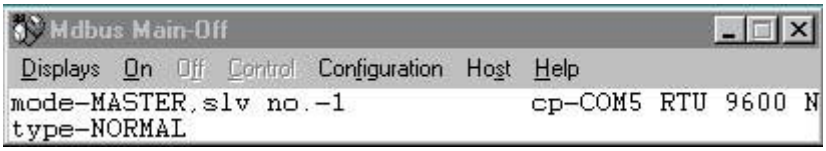
- Set the Baud Rate to 9600, non parity.
- Select the correct Database Points (values shown in yellow box):
  I. Regs Number 0, H . Regs Number 120

The LEDs TX and RX for port 2 on the Modbus Converter will start blinking and Comm. –Nrml will be shown on the Test Program.
If a fault is intentionally made on the AutroSafe, for instance, by removing a detector (one of the first 235 ID numbers), the corresponding register (in the Test Program Holding register) on the computer should change. This means that the communication is successful.

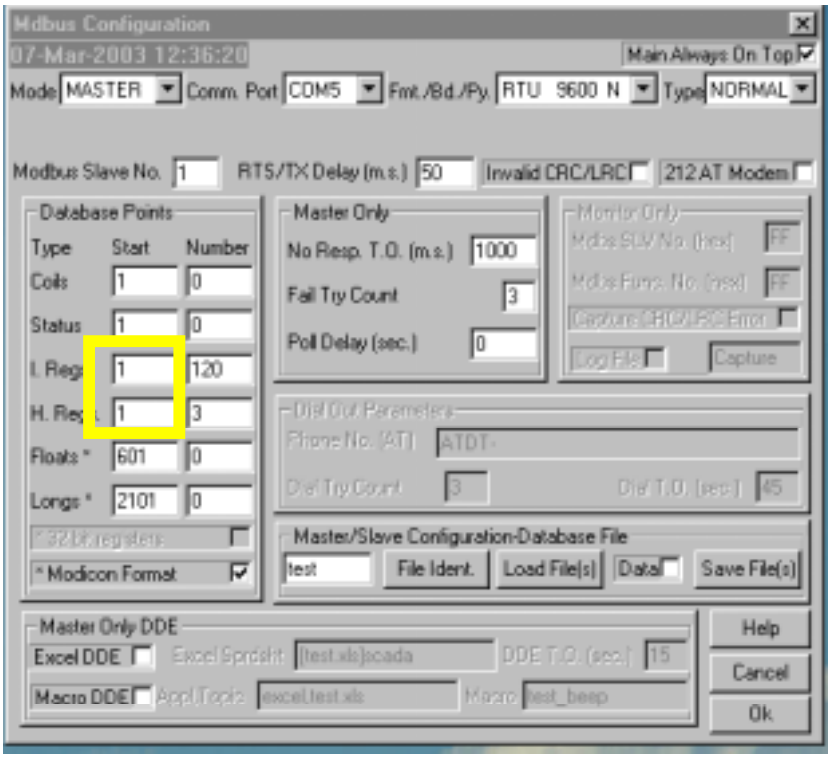
15.1.5 Verification Procedure – Modbus Slave

Note that the computer must be configured as Master if the BSL-330 is a Modbus *Slave*.

- Do the necessary cable connections (cables XBA-055 and XJA-037) between the computer, BSL-330 Module and the AutroSafe. Consult the drawing on the previous page.
- Switch the BSL-330 ON.
  The communication between BSL-330 and AutroSafe will start immediately. The Leds TX and RX for port 1 on the Modbus Converter will both blink.
- To start the Modbus Test Program on the computer, click the mdbus.exe icon.



- To start the communication between the computer and the Modbus, click **On** (the top level menu shown above).
- Select the correct Communication Port (COM5 is used in the example below).



- Set the Baud Rate to 9600, non parity.
- Select the correct Database Points (values shown in yellow box):
  I. Regs Number 120, H. Regs Number 3

The LEDs TX and RX for port 2 on the Modbus Converter will start blinking and Comm. –Nrml will be shown on the Test Program.

If a fault is intentionally made on the AutroSafe, for instance, by removing a detector (one of the first 235 ID numbers), the corresponding register (in the Test Program Input register) on the computer should change. This means that the communication is successful.

15.2 AutroConfig tool – special considerations

15.2.1 UnitIDs

AutroSafe configuration heavily controls the functionality of the AutroSafe system. The BSL-330 reports point status only.
In AutroSafe, the main key to address any single device is the UnitID. Even if it is named by a tag name, type no, LSI (Loop Sequence Ident) or similar, only the UnitID is reported to the BSL-330. This UnitID is the key to the location of the detector in the ProfiBus/Safe registers.
When setting up the configuration in the PLC according to the AutroSafe information, it is essential to use the correct UnitID.

The UnitID is visible in the AutroConfig tool when editing the configuration of the system. It may be edited as well, but this should be done only as an excemption, as it only adds effort.

When compiling the Configuration data, a text file “UnitName.txt” is generated. This file includes absolutely all names and their UnitID in the AutroSafe System configuration.

The 0x0001 HT_1_001 is the first Fire Detector in the system. All fire detectors are sorted in the range 0x000 to 0x7FFF.
0x0001 is the UnitID, and “HT_1_001” is a free, user defined text for the unit, called the Tag Name.

Note that when deleting a point in Config, the UnitID is still allocated, but not used. This reduces the available amount of points for the BSL-330 to report, as there is a maximum numberof 472.
Also, care must be taken when reconfiguring a system, as a deletion and replacement of detectors will make new UnitIDs to these.

15.3 Service / Maintenance

No maintenance is required.

If the unit is not working correctly please see Troubleshooting, chapter 12. If the unit is still not working send it back to the manufacturer for service. Fill out a Non Conformity Report carefully. The Non Conformity Report should be sent to AFS and one copy should follow the unit in question.

Some key data to be noted:

- Date and name of author.
- Serial number of unit
- Type and SW – versions of AutroSafe Panel
- Type of PLC, including relevant data
- Sequence of actions and observations. Give precice timing of actions and observations (avoid “quickly” or “after some time”). Describe what you expected to happen, and the observed deviation.
- Detailed measurements made in chapter x
- Detailed error messages given by AutroSafe panel and PLC

On-site service can be performed by using a PC running the AutroCom Test Program.

15.4 Modbus functions implemented in the Slave BSL-330/1 and BSL-330/3

These are the functions available to a PLC.

No	Function	Use in BSL-330
3	Read Holding Registers	The PLC can read back the **Command** register when using zeroing of command as execution handshake
4	Read Input Registers	The PLC can read the **Status** registers
6	Preset Single Register	The PLC can write the **Command** register
7	Read Exception Status	Returns zero
8	Diagnostic	Returns various diagnostic data.
11	Fetch Comm Event Ctr	Returns number of communication events
12	Fetch Comm Event Log	Returns a character array showing status of latest 64 events.
16	Preset Multiple Registers	The PLC can write all **Command** registers at once (recommended to fill in Command 2 and 3, then 1!)
17	Report Slave ID	Returns device ID code, default 1. Can be changed in BSL-330 Config.
19	Reset Comm Link	Resets the communications link. In the BSL-330 it simply flushes the input buffer

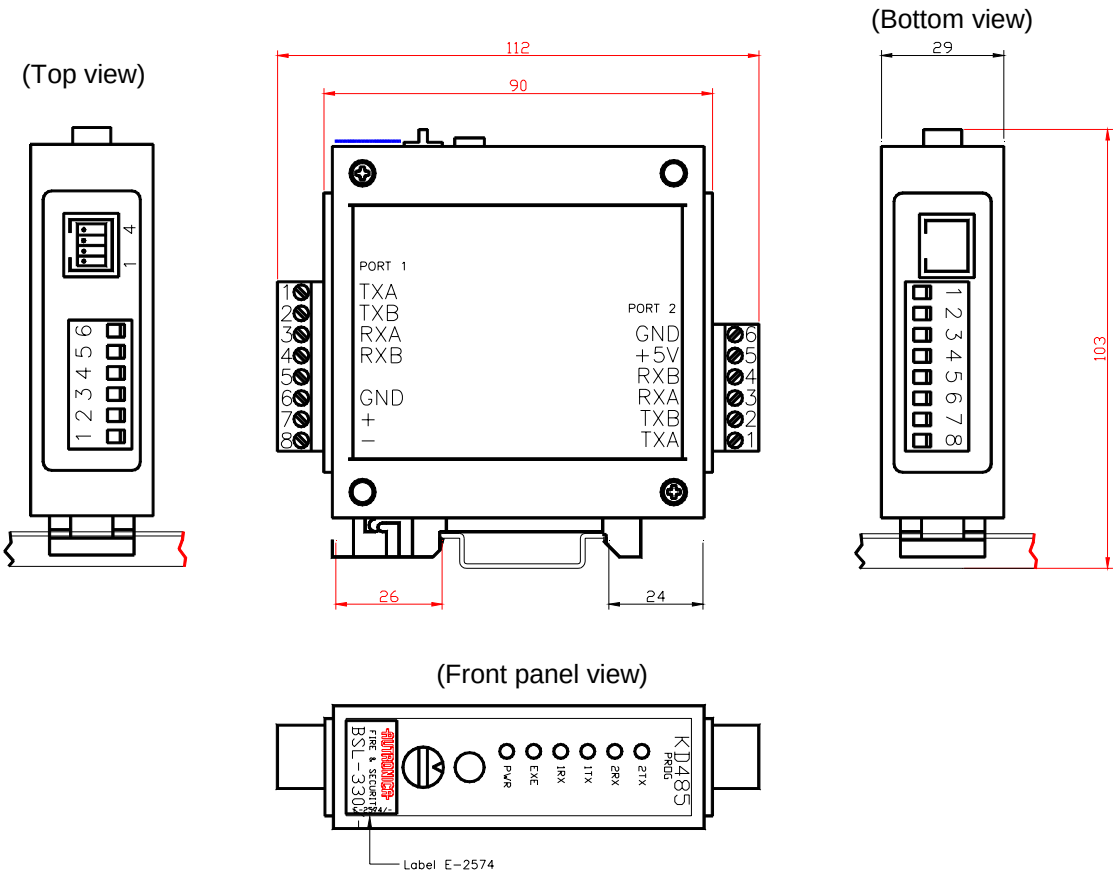
15.5 Modbus functions implemented in the Master BSL-330/2 and BSL-330/4

The BSL-330/2 Master and BSL-330/4 uses these Modbus functions:

No	Function	Use in BSL-330
3	Read Holding Registers	Reads **Commands** from the PLC
6	Preset Single Register	Writes one register to the PLC every time an AutroSafe **Status** event occurs. This means that AutroSafe events are reported very quickly to the PLC.
16	Preset Multiple Registers	All **Status** registers are written to the PLC in situations where the PLC is out of synch with AutroSafe: - BSL-330 startup - Modbus communication repaired - high traffic from AutroSafe (internal event queues overflowed)

15.6 Overview

The drawing below gives an overview of the screw terminals.



15.7 Terms and Abbreviations

Term / Abbreviation	Explanation
Activation	To bring a *component* into (one of) its active activation states (depending on type, a component may have several active activation states). Components may be activated and deactivated either on command or on alarm.
Alarm Zone	The geographical area throughout which Fire Alarm Devices give identical alarm signals present identical audible information in response to the same event. An alarm zone is activated by one or several Detection Zones. The alarm zone assigned to the detection zone in alarm is called the parent alarm zone. Fire Alarm Devices in a parent alarm zone will always give EVACUATE signal. To any (parent) alarm zone there may be defined a number of neighbour alarm zones. Fire Alarm Devices in neighbour alarm zones will give alert signal when its parent alarm zone gives EVACUATE signal.
AUTROLON	Autronica's Local Operating Network
BLC-Eq	Basic Loop Controller Equipment (equipment part for all Loop Units and I/O modules, i.e. Eq-part for Loop-Ctrl, Point-Ctrl, FPE-Ctrl etc.)
Component	An assembly of one or more modules, implementing a system function. The following components are defined in the AutroSafe Interactive Fire Alarm System (also see detailed description of *Components,* Chapter 1): • Points (fire detectors, manual call points) • Detection Zones • Fire Protection Equipment (fire extinguishers, ventilation controllers) • Fire Alarm Devices (sounders, information panel, visual indicator) • Fire Alarm Routing Equipment • Fault Warning Routing Equipment • Operator Panels
Condition	Meaning similar to «state», but used only in conjunction with the control and indication equipment. (EN54 standard).
Control and indicating equipment (c.i.e)	Equipment supplying power to, as well as accepting fault and alarm signals from detectors. A c.i.e. will indicate an alarm condition audibly as well as visibly and indicate the location of danger.
Deactivation	To bring a component into its inactive activation state (a component can have only one inactive activation state). Examples of deactivation are turning a fire extinguisher off and silencing a sounder.
Detection Loop	Loop circuit connecting a number of fire detectors, manual call-points and other Loop Units. A detector loop is connected to control and indicating equipment.
Detection Zone	One or more fire detectors and/or manual call-points logically belonging together for geographical, functional or other reasons.
Disable(ment)	When you disable an *active* component, for example, a sounder issuing an alarm signal, the component will immediately switch to the OFF state without any user notification and/or confirmation cause. A disablement of a *deactivated* component, for example, a sounder not issuing an alarm signal, will have no immediate effect on system operation. Both activated and deactivated disabled components will remain switched off until enabled.
Domain Network	The domain network consists of a number of components, connected over AUTROLON.
Enable(ment)	Setting the arm state of a disabled *deactivated* component to ENABLED will have no immediate effect on system operation. The component will remain deactivated until its activation state is set to an active state (on alarm or on command).
Fault Warning Routing Equipment (FWRE)	Intermediate equipment which routes a fault warning signal from (B) to a fault warning signal receiving station.

Term / Abbreviation	Explanation
Fire Alarm Device (FAD)	Equipment used to give warning of fire, for example, sounder or visual indicator.
Fire Alarm Recieving Station	A centre from which the necessary fire protection measures can be initiated at any time.
Fire Alarm Routing Equipment (FARE)	Intermediate equipment which routes an alarm signal from control and indicating equipment to a Fire Alarm Receiving Station.
Fire Detector	The part of an automatic fire detection system which constantly or at frequent intervals monitors suitable physical and/or chemical phenomena for detection of fires in the area under surveillance.
Fire Protection Equipment (FPE)	Fire control or fighting equipment, e.g. extinguishing installation.
Loop Unit	Either a Point, and I/O-unit or and Electronic Sounder that is connected to a Detection Loop.
Manual Call-Point	A device for the manual initiation of an alarm.
Operation Zone	An Operation Zone defines the scope of an Operator Panel. One operation zone may encompass one or more detection zones. Operation zones are allowed to be contained in other operation zones, building an hierarchy consisting of different levels of operation zones. Operation zones must be fully contained in each other, i.e. the operation zone can not be partly contained in (overlap) another operation zone. One operation zone may be controlled by more than one Operator Panel.
Point	Detectors or manual call-points. Each point is assigned zone membership on individual basis. A point can be a member of one detection zone only. A point may signal a number of different alarm levels. A manual call-point can only signal a Fire Alarm Level. To each point there will be assigned a delay parameter, notifying whether actions to be initiated upon reception of a Fire Alarm signal from the point should be delayed or not. The delay parameter is only valid in conjunction with Delayed Action or SOLAS.
SOLAS	A program version of the AutroSafe software, spesially designed for maritime application - Safety Of Life At Sea (SOLAS).
SVD	Self Verifying Detection
MSW	Most Significant Word
LSW	Least Significant Word
MSB	Most Significant byte
LSB	Least Significant byte

16. Reader's Comments

Please help us to improve the quality of our documentation by returning your comments on this manual:

Title: *Interfacing Third Party Modbus Compatible Equipment*
AutroSafe Interactive Fire Alarm System, Release 3.4.1,

Ref. No.: *P-MODBUS/EE Rev. B, 041201*

Your information on any inaccuracies or omissions (with page reference):

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Suggestions for improvements

Thank you! We will investigate your comments promptly.

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Autronica Fire and Security AS is an international company, based in Trondheim, Norway and has a world-wide sales and service network. For more than 40 years Autronica's monitoring systems have been saving lives and preventing catastrophes on land and at sea. Autronica Fire and Security's most important business area is fire detection & security. Autronica Fire and Security stands for preservation of environment, life and property.

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Stringent control throughout Autronica Fire and Security assures the excellence of our products and services. Our quality system conforms to the Quality System Standard NS-EN ISO 9001, and is valid for the following product and service ranges: marketing, sales, design, development, manufacturing, installation and servicing of:

- fire alarm and security systems
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In the interest of product improvement, Autronica Fire and Security reserves the right to alter specifications according to current rules and regulations.

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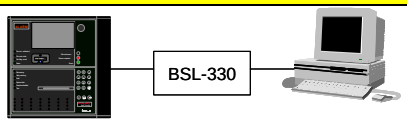
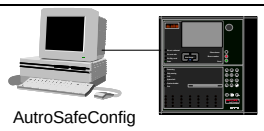
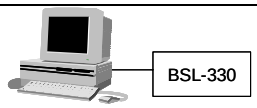
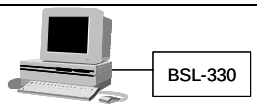
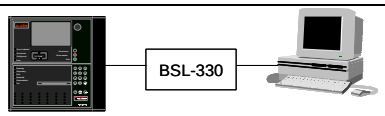
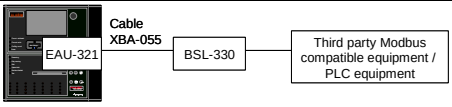
Quick Reference Guide for all necessary steps

Chapter / procedure			Remarks
15	**Verifying the communication between AutroSafe and the BSL-330 Converter using the default configuration of the BSL-330 Converter** *(page 96)*		Before customizing the configuration of the BSL-330 Converter, it is possible to verify that the cabling and communication between AutroSafe and the BSL-330 Converter is successful and that BSL-330 operates correctly with AutroSafe. This verification is based on the default configuration of the BSL-330 Converter (Master / Slave).
5	**Planning related to the third party Modbus compatible equipment / PLC equipment that is to be used** *(page 22)*		Information about the third party Modbus compatible equipment you must be aware of before commissioning (basic information and special issues).
6	**Getting familiar with the BSL-330 Configuration** *(page 30)*		Information about the BSL-330 Configuration.
7	**Configuring the AutroSafe system** *(page 39)*		The procedure deals with the configuration of the AutroSafe Interactive Fire Alarm System. The AutroSafe Configuration Tool is used for this purpose.
8	**Preparing the BSL-330 Converter** *(page 46)*		The BSL-330 is delivered with a standard setup (parameter settings) from the factory. This chapter provides information on the necessary preparations of the module. The KD-485 Configuration Program is used for this purpose.
9	**Configuring the customised setup of the BSL-330 Converter** *(page 51)*		The procedure deals with the setup related to the third party Modbus compatible equipment / PLC equipment that is to be used. The AutroCom Test Program is used for this purpose.
10	**Verifying the customised setup of the BSL-330 Converter** *(page 58)*		The procedure verifies that the customised setup is successful.
11	**Verifying the complete system setup** *(page 60)*		The procedure provides information on how to verify the complete system setup. The AutroSafe system is used to activate various events, i.e. fire alarms, prealarms, fault messages, etc.

Quick Reference Guide for Configuring the PLC

1) Modbus Function Codes

- Slave, chapter 15.4
- Master, chapter 15.5

2) Register setup, chapter 14.4

3) Configuration

- Parameter definitions, chapter 13
- Download, chapter 9.3

4) Connections to the Modbus interface, chapter 3.4.4