InteliGen NT
InteliGen NTC
InteliGen NT BaseBox
InteliGen NTC BaseBox
InteliSys NT
InteliSys NTC BaseBox

Inteli Mains NT

Inteli Mains NT BaseBox
Inteli Mains NTC BaseBox

IGS-NT SW version 3.0

COMMUNICATION GUIDE

Table of contents

Scope of the document

There are following types of communication between controller(s) and superior system in the controller.

1. Local (on site) communication

    - via ComAp software
    - via MOUDBUS (MODBUS RTU or MODBUS TCP)

2. Remote communication

    - via Ethernet
    - via Internet (AirGate)
    - via MODEM

These types of connections are available via RS232, RS485, USB, ETHERNET communication ports.

Definition of terms

Local connection
Type of connection using direct connection on site via protocol of ports on the controller. Length of connection is given by protocol specification.

Remote connection
Type of connection using standard communication lines such as Internet, modem connection and GSM connection for communication between controller and other superior device.

Comap Protocol
Communication between PC with ComAp software (InteliMonitor, GenConfig) and controller is running on this protocol.

3rd party software
Software using standardized protocol for sharing of data between particular systems (for example ModBus RTU, ModBus TCP etc.).

Single gen-set communication
This type of connection allows communication only with one controller. Communication with other controllers on site via this type of connection is not possible.

Multiple gen-set communication
This type of connection allows communication with more than one controller on site via single communication link.

Monitoring
Type of communication used for continuous displaying of process data and process control of the system.

Configuration
Type of communication used for writing of configuration file into the controller.

Note:

There are used some abbreviations for resolution of all hardware variations of IGS-NT controllers in this document. These abbreviations correspond with order codes of each HW variation.

InteliSys NTC Basebox	IS-NTC-BB
InteliSys NT	IS-NT-BB
InteliGen NTC Basebox	IG-NTS-BB
InteliGen NT Basebox	IG-NT-BB
InteliGen NTC	IG-NTC
InteliGen NT	IG-NT
InteliMains NTC Basebox	IM-NTC-BB
InteliMains NT Basebox	IM-NT-BB
InteliMains NT	IM-NT

Controllers communication capabilities

IG/IS/IM-NTC-BB - Communications
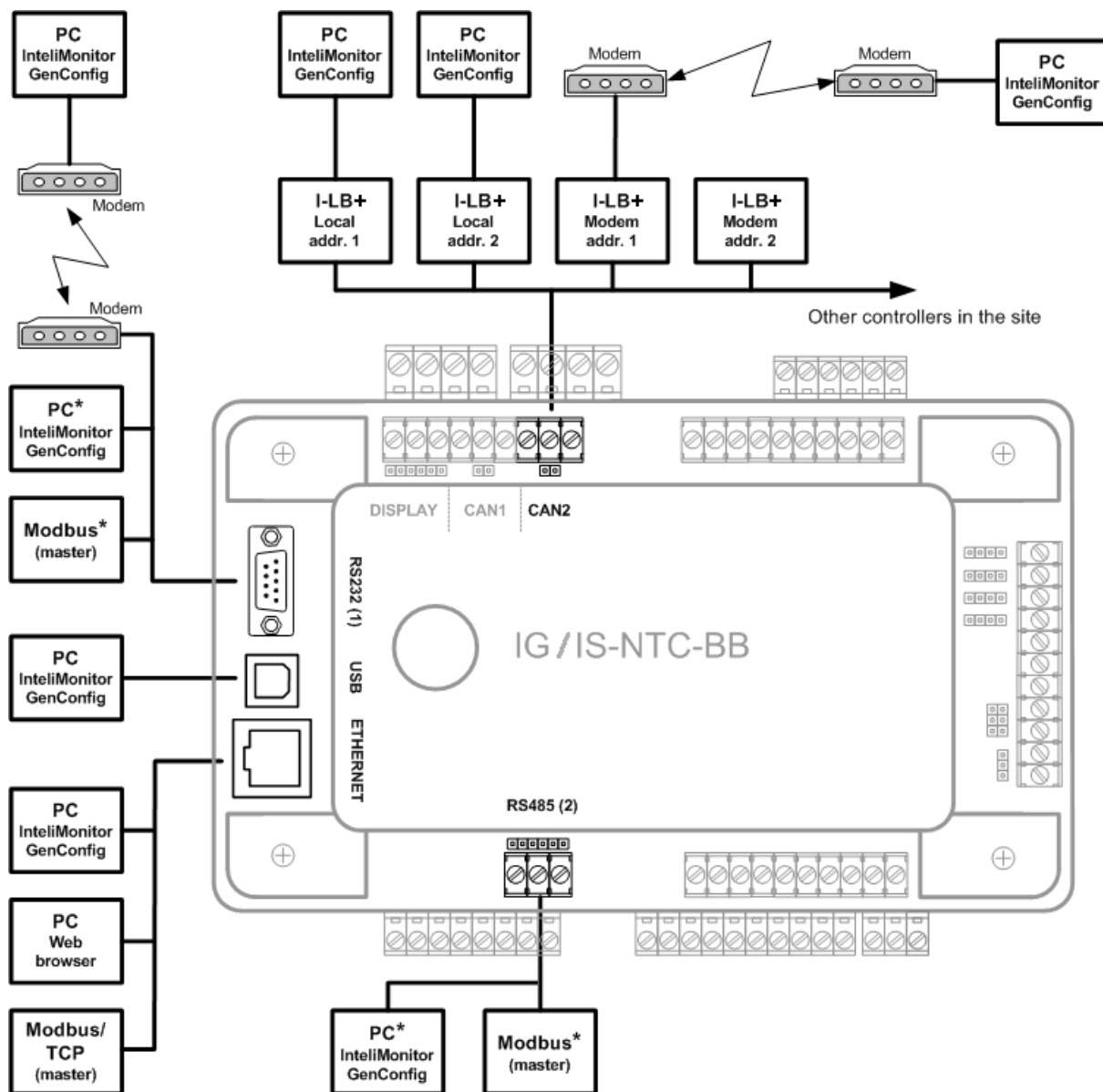
* Only one device can be connected to the respective communication port, device type is selectable by setpoint

IG/IS/IM-NTC-BB - Terminals
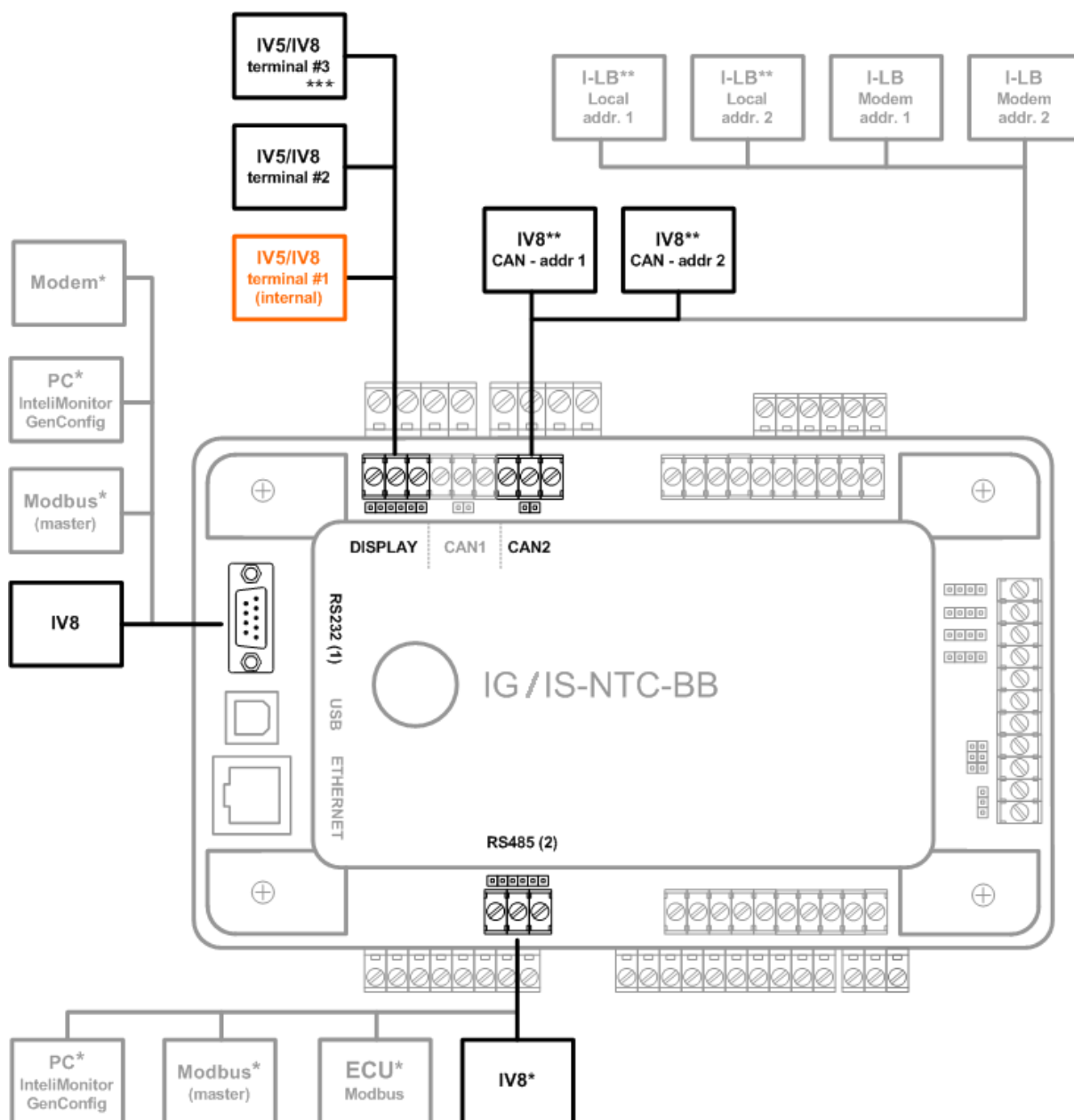
IV5/IV8 terminal #3 ***

IV5/IV8 terminal #2

IV5/IV8 terminal #1 (internal)

I-LB** Local addr. 1

I-LB** Local addr. 2

I-LB Modem addr. 1

I-LB Modem addr. 2

IV8** CAN - addr 1

IV8** CAN - addr 2

Modem*

PC* InteliMonitor GenConfig

Modbus* (master)

IV8

DISPLAY   CAN1   CAN2

RS232 (1)

USB

ETHERNET

IG/IS-NTC-BB

RS485 (2)

PC* InteliMonitor GenConfig

Modbus* (master)

ECU* Modbus

IV8*

* Only one device can be connected to the respective communication port, device type is selectable by setpoint

** The CAN local address 1 and 2 can be used either for an I-LB or an IV8

*** Only for IS-NTC-BB

IG/IS/IM-NTC-BB - Peripheral modules
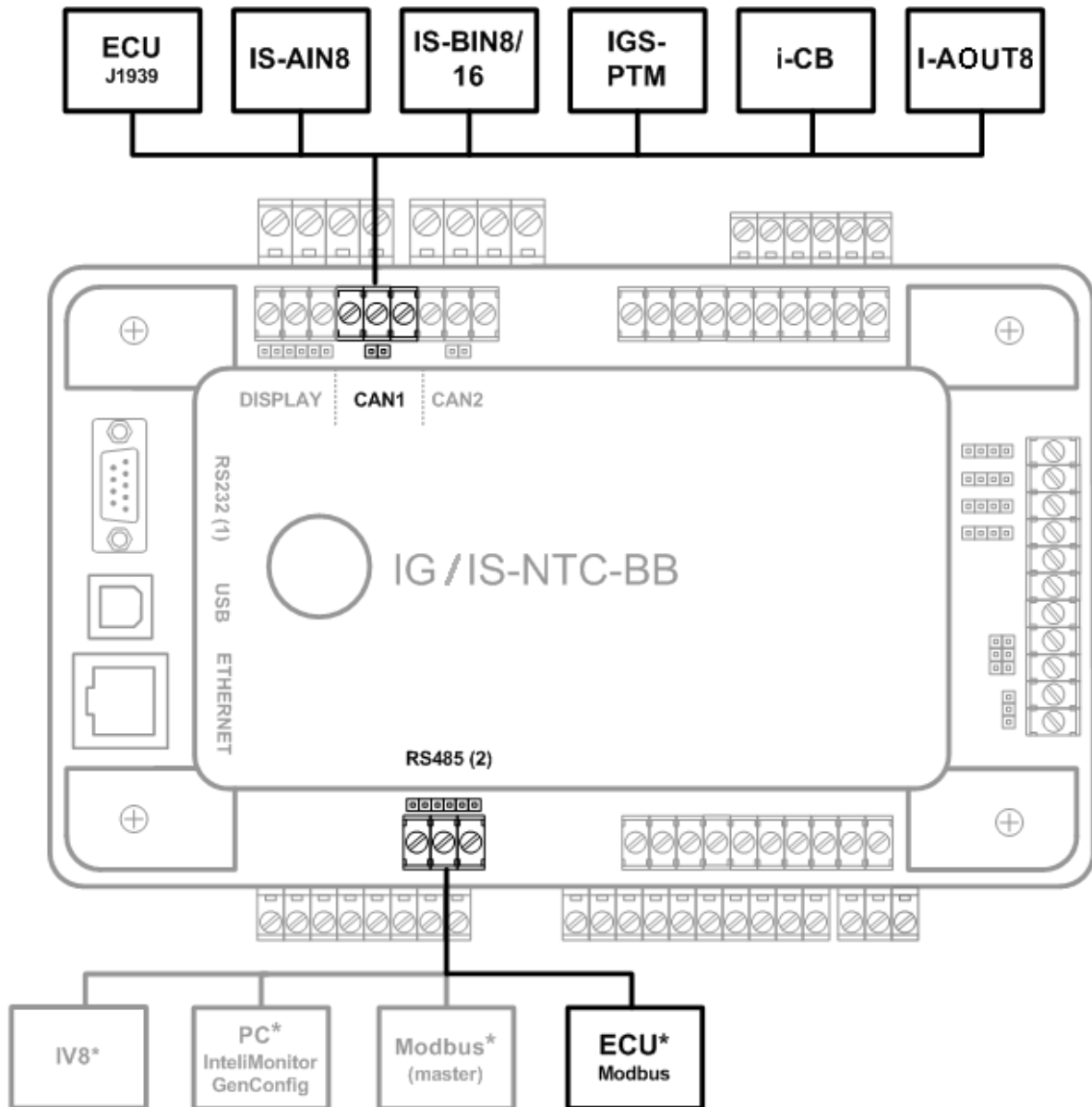
* Only one device can be connected to the respective
communication port, device type is selectable by setpoint

IG/IS/IM-NTC-BB - Jumpers settings

PULL DOWN
TERMINATOR
PULL UP

TERMINATOR
120Ω

TERMINATOR
120Ω

DISPLAY   CAN1   CAN2

RS232 (1)

USB

ETHERNET

BOOTJUMPER

IG / IS-NTC-BB

IB-COM - Reset to default settings jumper

RS485 (2)

PULL UP
TERMINATOR
PULL DOWN

A   COM   B

RS485
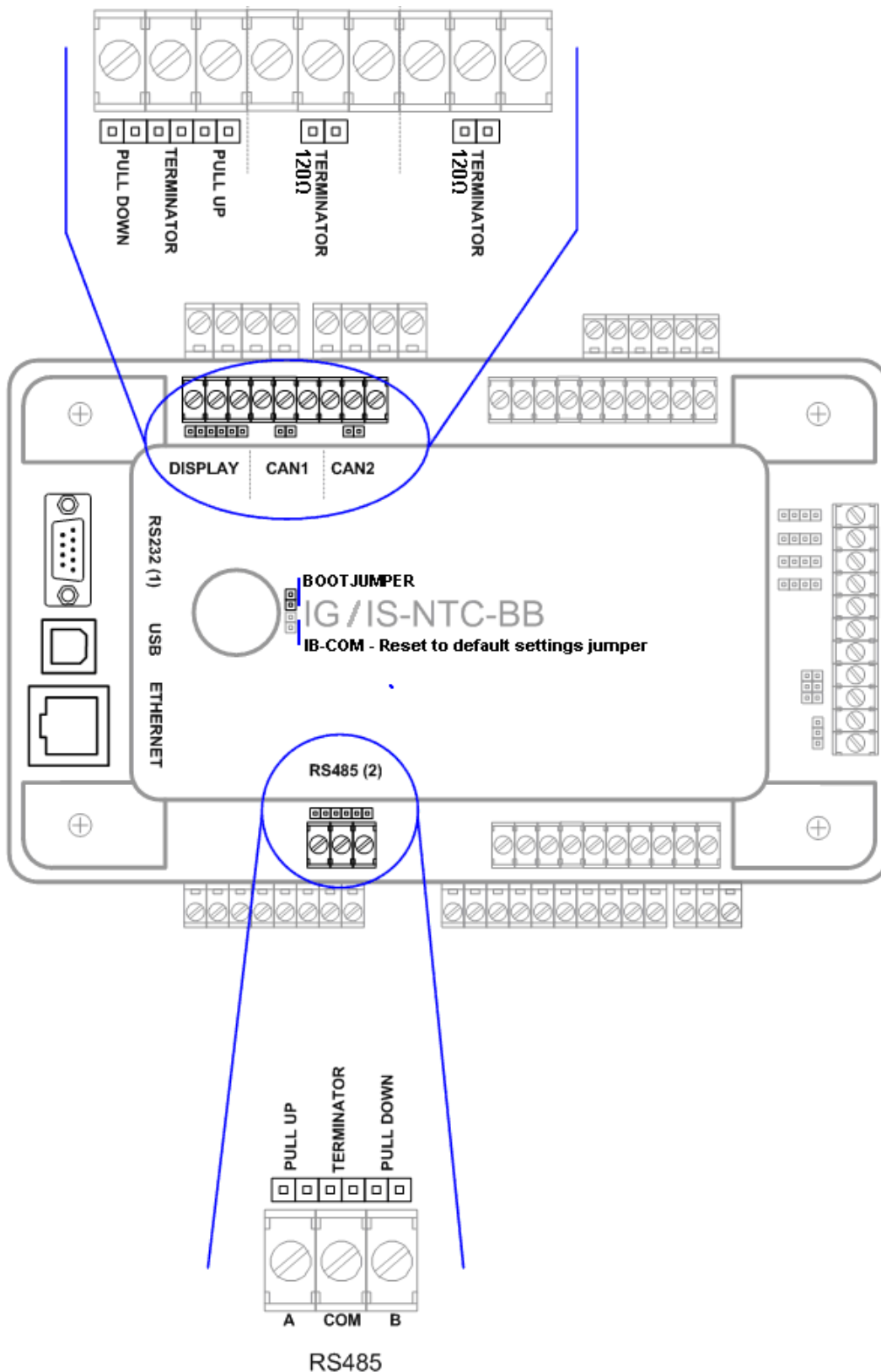
IG/IM-NT-BB - Communication
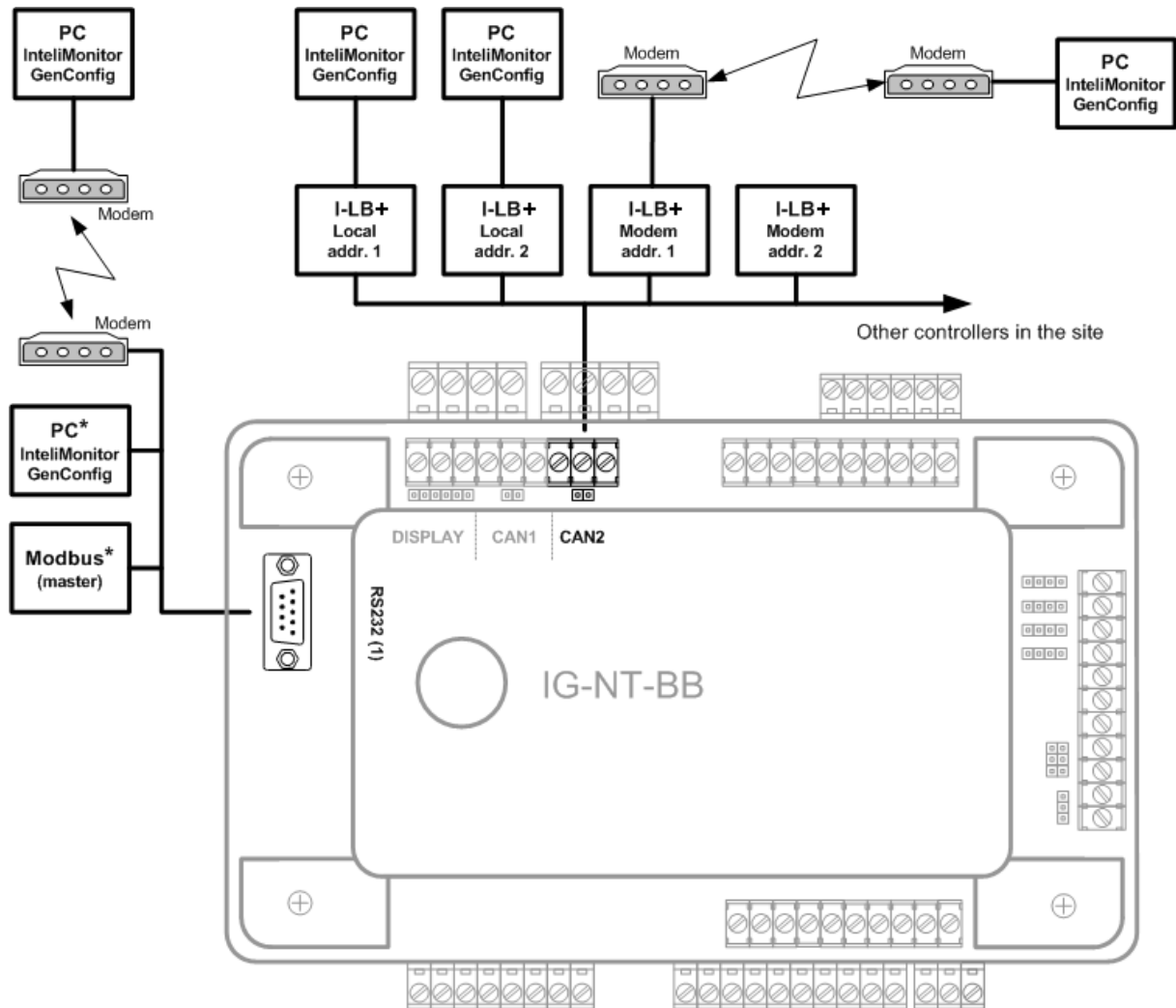
* Only one device can be connected to the respective communication port, device type is selectable by setpoint

IG/IM-NT-BB - Terminals
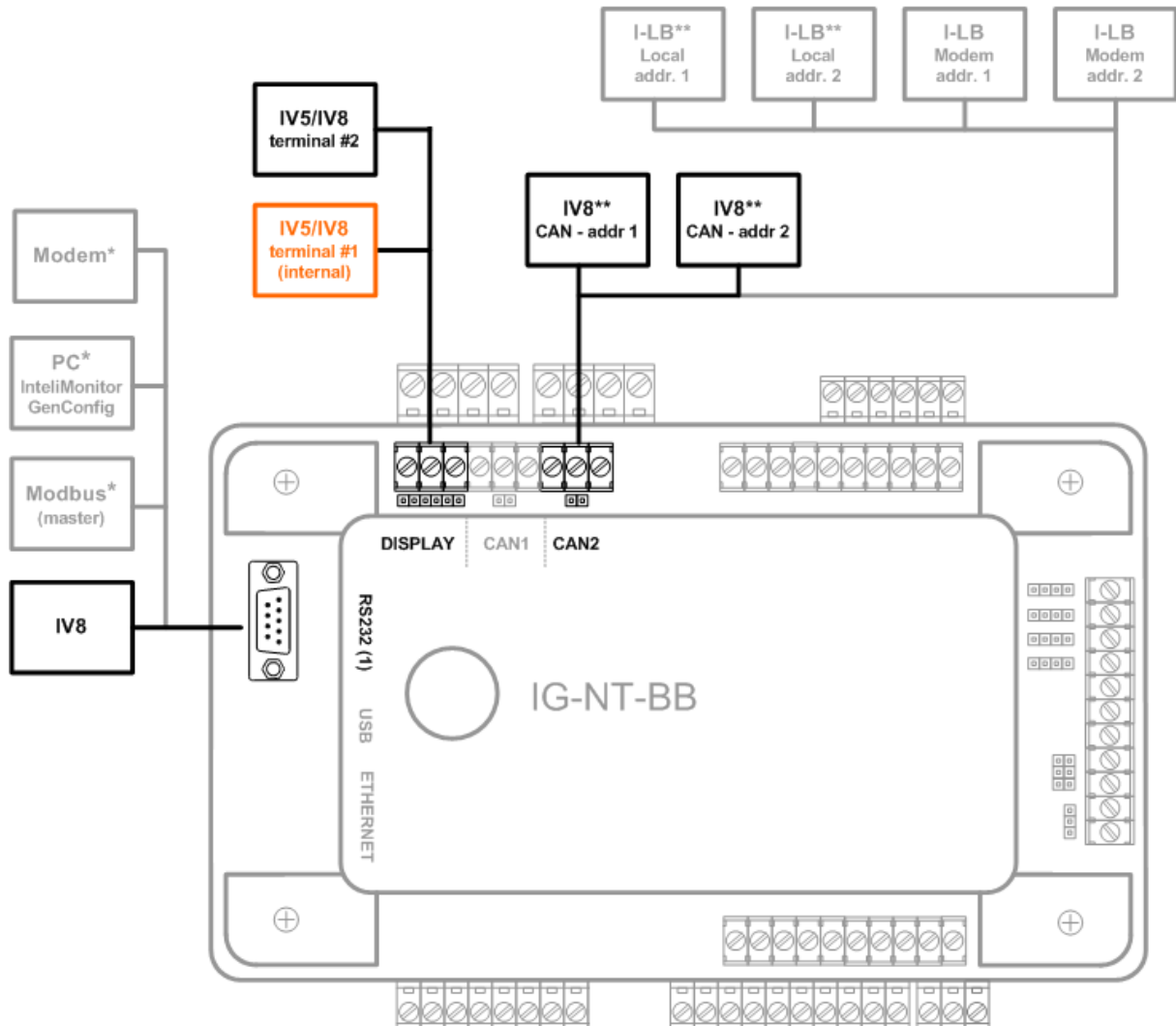
* Only one device can be connected to the respective communication port, device type is selectable by setpoint

** The CAN local address 1 and 2 can be used either for an I-LB or for an IV8.

IG/IM-NT-BB - Peripheral modules
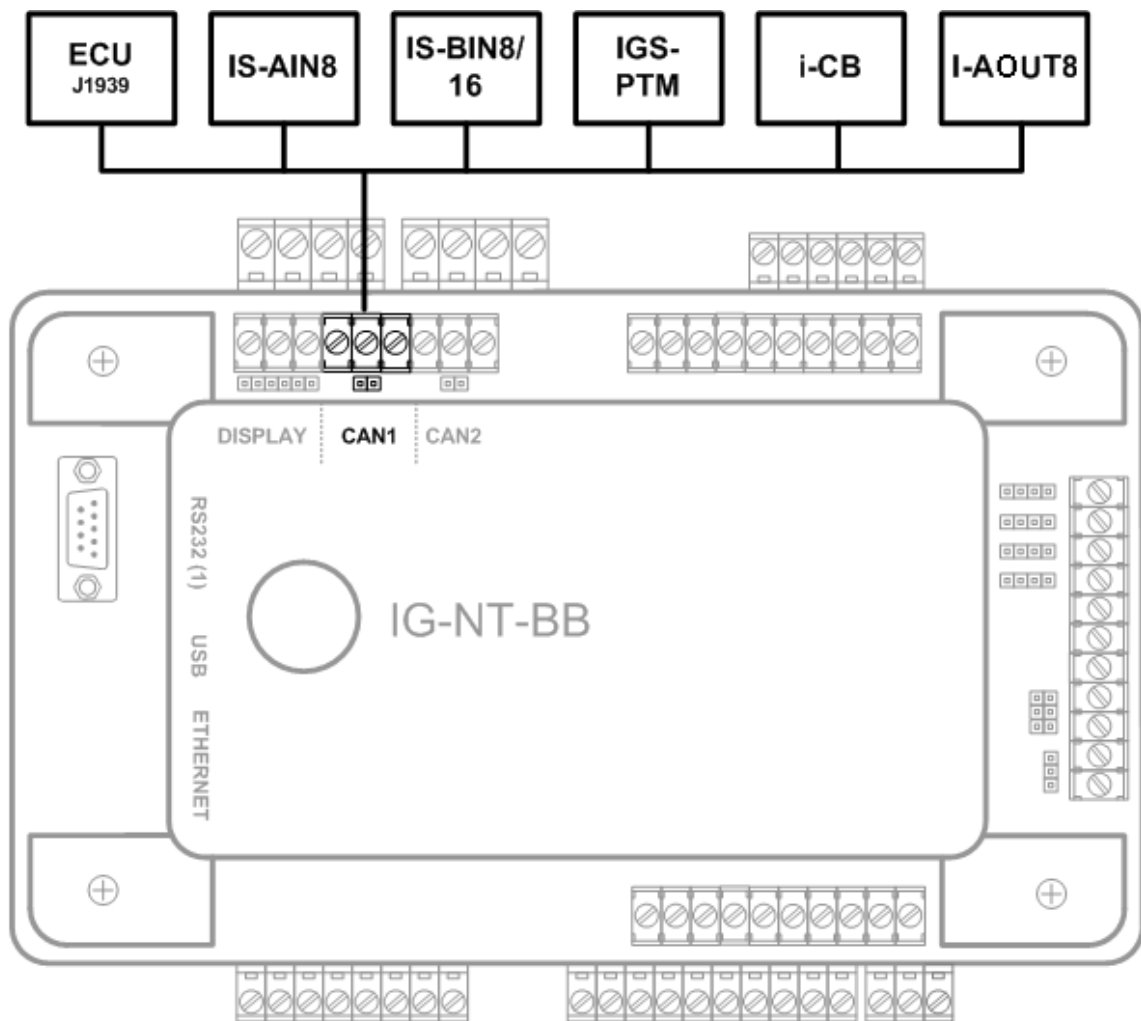
* Only one device can be connected to the respective
communication port, device type is selectable by setpoint

IG/IM-NT-BB - Jumpers settings
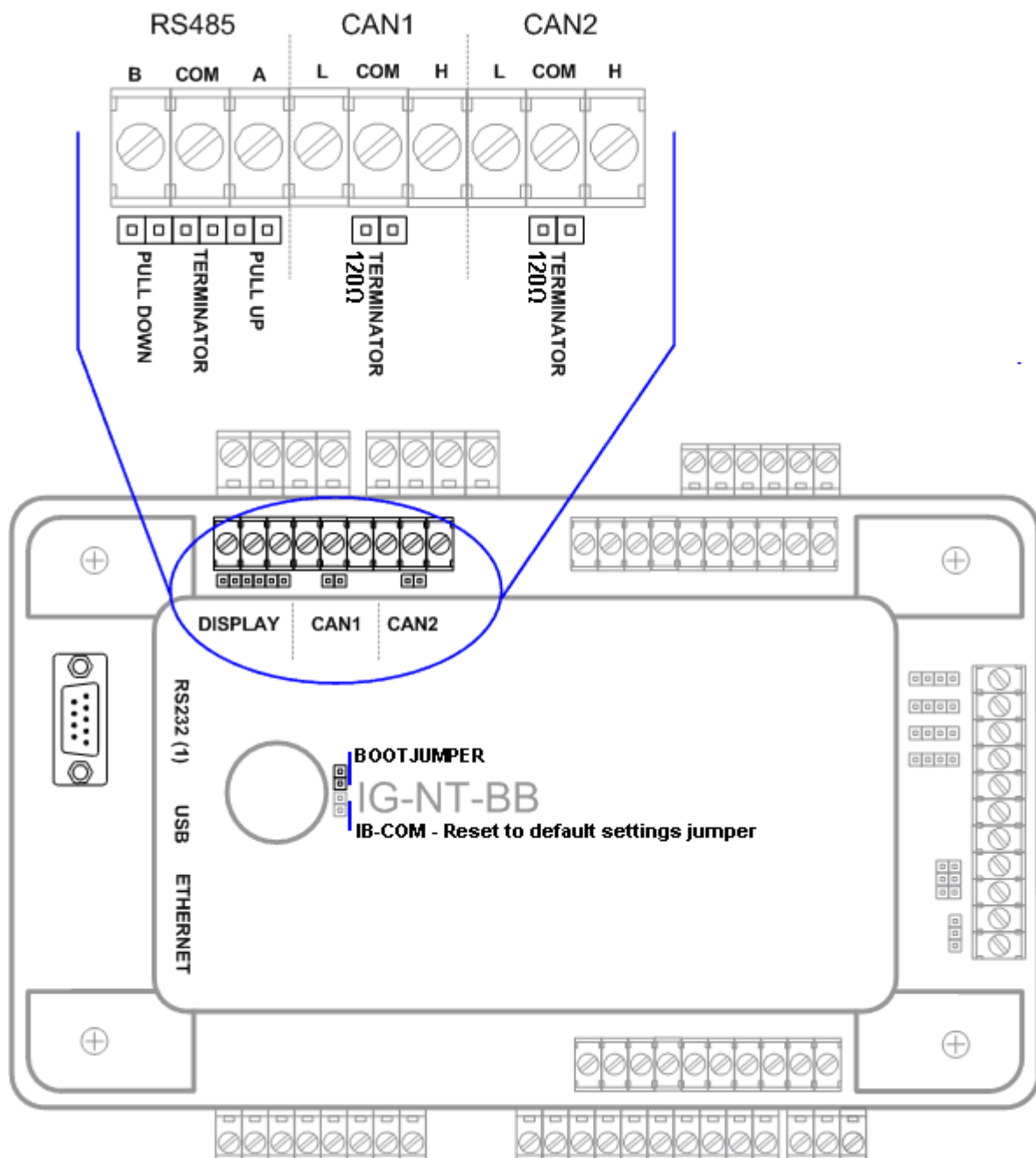
IG-NTC - Communications, Terminals
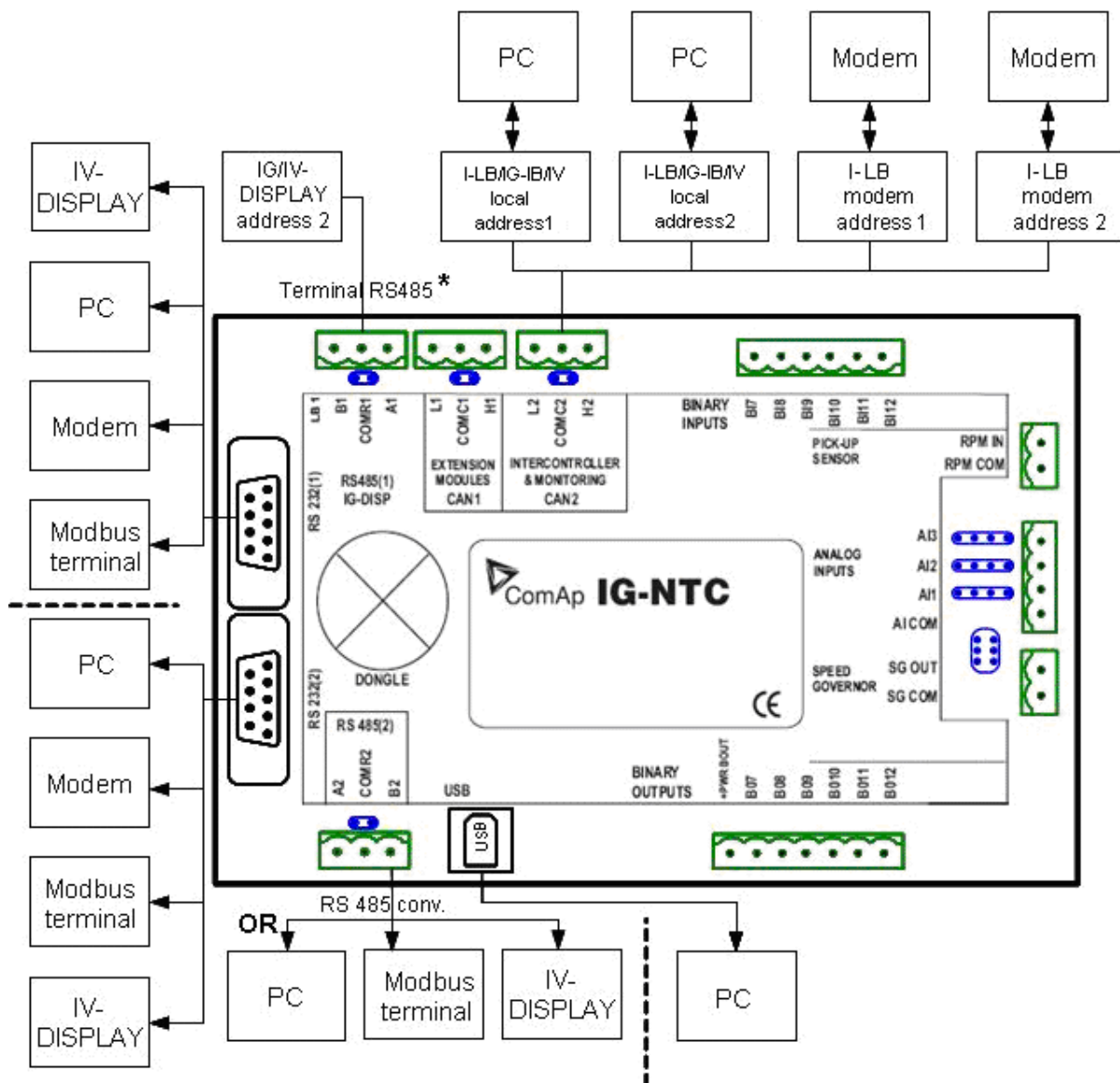
*If Communication settings:
RS485(1) convertor = enabled, IG/IV-Display 1,2 cannot be used simultaneously.
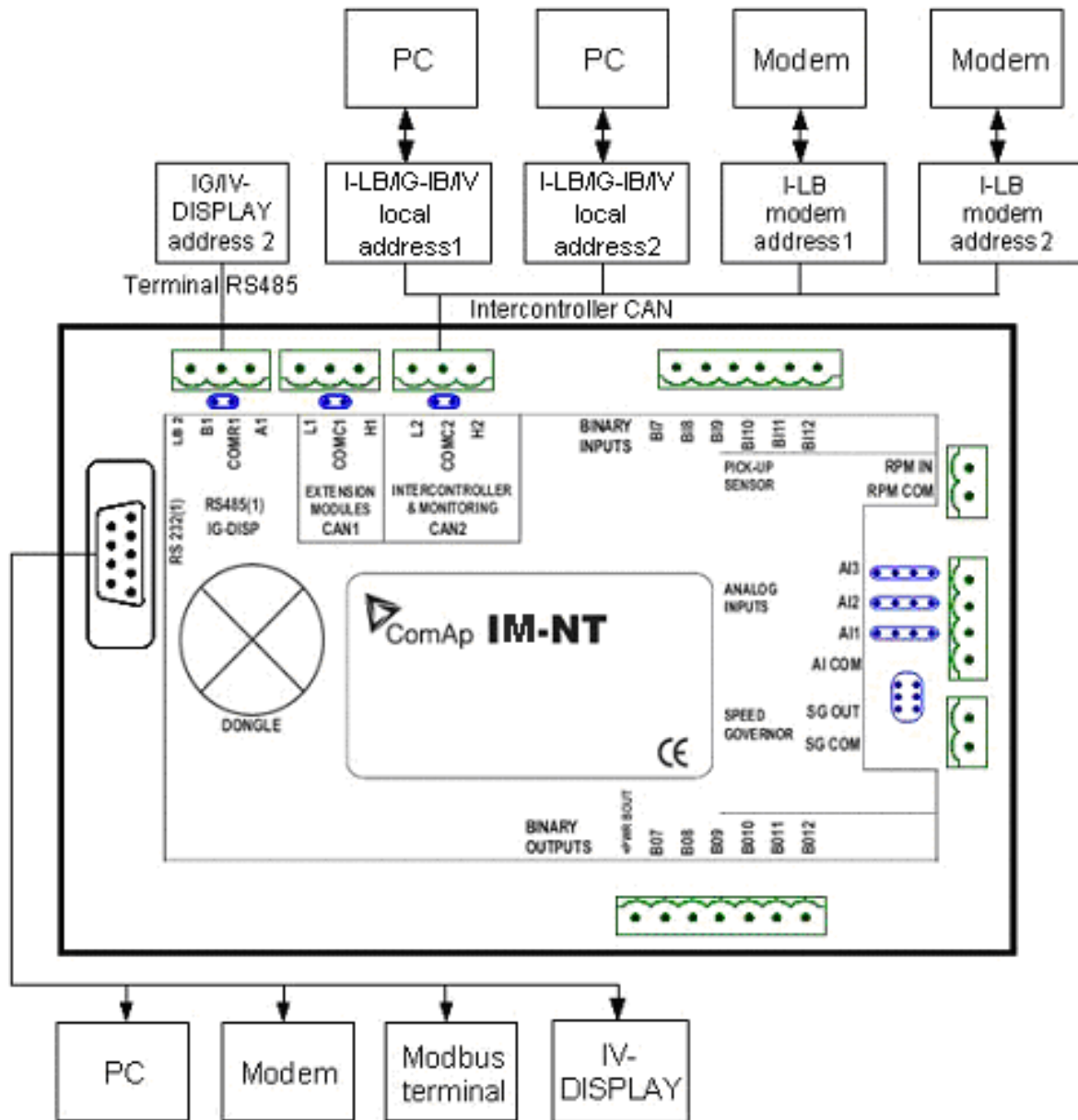
Monitoring Local on site - Comap SW

Direct PC connection to Single gen-set

RS232 connection

RS232

PC

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	RS232(1)	RS232(1)	RS232(1)	RS232(1)	RS232(1)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS232(1)	RS232(1) RS232(2)	RS232(1) RS232(2)	RS232(1)

Hint:
Other way how to realize RS232 connection is via external bridge I-LB+.

Controller setup

(**Setpoints/Comms settings** group)

RS232(1) mode = DIRECT
RS485(1) conv. = DISABLED

Equipment

	Equipment needed
Controller side	-
Connection	RS232 cable up to 10m
PC side	RS232 connection or RS232/USB converter

USB connection
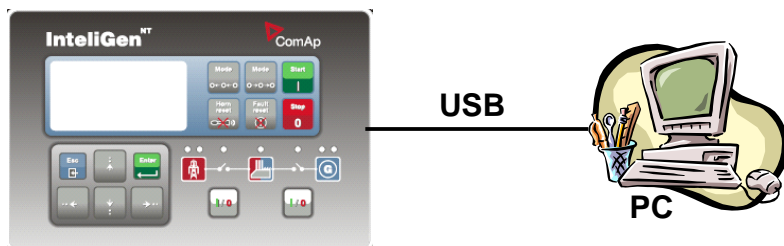
Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	external bridge	USB	USB	external bridge	USB

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	YES	YES	NO
Available ports	external bridge	USB	USB	external bridge

Hint:
Direct USB connection is not possible for some controllers, however USB connection is available for all mentioned controllers via external bridge I-LB+.

Controller setup

(**Setpoints/Comms settings** group)

No special settings are required

Equipment

	Equipment needed
Controller side	-
Connection	USB cable A-B
PC side	USB connection

RS485 connection
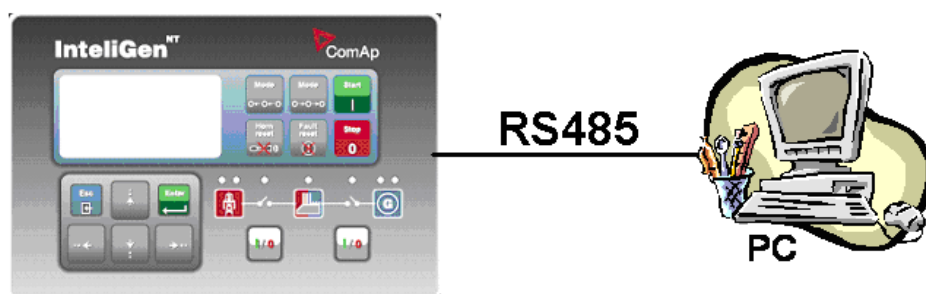
Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	external bridge	RS485(2)	RS485(2)	external bridge	RS485(2)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS485(1)	RS485(1) RS485(2)	RS485(2)	RS485(1)

Hint:
Direct RS485 connection is not possible for some controllers, however RS485 connection is available for all mentioned controllers via external bridge I-LB+.

Controller setup

(**Setpoints/Comms settings** group)

RS232(2) mode = DIRECT
RS485(2) conv. = ENABLED

Equipment

	Equipment needed
Controller side	-
Connection	RS485 cable - Twisted pair, length up to 1 km
PC side	Converter RS485/RS232 or USB

Hint:
RS485 connection can be used for gen-set control for longer distance. IG-NT-BB has no possibility of direct connection to RS485 bus. This controller provides RS232 port only. External converter from RS232 to RS485 is needed.

Ethernet connection (Direct)
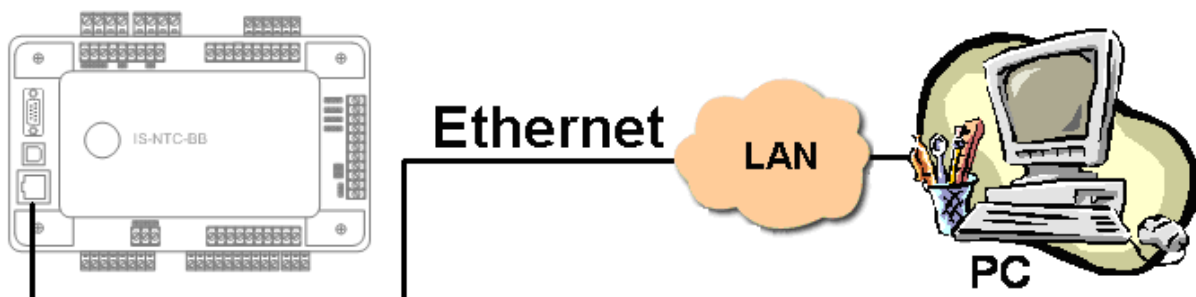
The Internet (Ethernet) connection is a point-to-point connection between a PC and a controller or site via an TCP/IP protocol-based network. The physical configuration of such network can be a small local area ethernet network as well as the Internet.

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES

Available ports or modules	-	ETHERNET	ETHERNET	-	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	NO	NO	NO
Available ports or modules	-	-	-	-

Hint:
Ethernet connection is available for all mentioned controllers via external bridge IG-IB or IB-NT (see the chapter Ethernet connection via IG-IB/IB-NT).

Number of clients connected simultaneously

2 clients with InteliMonitor or WebSupervisor (Comap/TCP protocol)
2 clients with web interface

Using a web browser

Ethernet connection to controller makes possible using any web browser for basic monitoring and adjustment of the controller. Simply put the IP address of the module into the address line in your web browser like http://192.168.1.254 and then enter access code. In case of connection from web browser there is 5 minutes timeout after closing the browser window. After that the client is automatically logged out.

Ethernet connection settings

Parameters can be set via any type of connection (USB, RS232, Ethernet). Setup is provided via InteliMonitor. For Ethernet connection set these parameters in *Comms Settings* group:

IP addr mode		FIXED
IP address		192.168.1.254
Net mask		255.255.255.0
Gateway IP		192.168.1.1
ComApProtoPort		23
AirGate		DISABLED
AirGate IP		

NOTE:
The IP addresses of the controllers must be accessible from the remote computer. If the remote computer is connected into another LAN segment than the gen-sets are, there must be a gateway(s) that enable direct traffic between the segments. If the remote computer is connected via Internet, then the internet gateway of the LAN where gen-sets are connected must have public IP address, must allow incoming traffic and must provide port forwarding from the external public IP to the different internal gen-set IPs according to the port used.

INTERNET GATEWAY CONFIGURATION EXAMPLE (PORT FORWARDING)

Equipment

	Equipment needed
Controller side	-
Connection	Ethernet cable to LAN, for point to point connection between PC and controller use cross-wired cable
PC side	ETHERNET connection

Direct PC connection to Multiple gen-sets

RS485 connection

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	RS485(2)	RS485(2)	-	RS485(2)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES

Available ports	RS485(1)	RS485(1) RS485(2)	RS485(2)	RS485(1)

Controller setup

(**Setpoints/Comms settings** group)

RS232(2) mode = DIRECT
RS485(2) conv. = ENABLED

Hint:

IG-NT-BB has no possibility of direct connection to RS485 bus. This controller provides RS232 port only. External converter from RS232 to RS485 is needed.

Equipment

	Equipment needed
Controller side	-
Connection	RS485 cable - Twisted pair, length up to 1 km
PC side	RS232 connection, Converter RS485/RS232

RS232/485 connection (I-LB+)

Hint:

I-LB+ module enables monitoring and configuration up to 32 controllers interconnected via CAN(2) intercontroller bus. It is also possible to use I-LB+ for single controller connection.

I-LB+ hardware setup

(**all jumpers in those positions**)

HW/SW control	No matter
ComAp/ModBus	Open
ADDR1/ADDR2	Selection of CAN address. Open = ADDR1, Close = ADDR2 It is possible to use up to two I-LB+ devices in direct mode on CAN(2) bus. Let jumper open in case of using one I-LB+ module. Other I-LB module has to have this jumper closed. (read more about I-LB+ module)
DIRECT/MODEM	Open
RS485/RS232	Selection of communication port (jumper is in RS232 or RS485 position)
Comm. speed.	No matter
RS485 120 Ohm	Open = terminator not connected, Close = terminator connected
CAN 120 Ohm	Open = terminator not connected, Close = terminator connected

USB DISABLED/ENABLED   Open

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+

Equipment

	Equipment needed
Controller side	I-LB+ unit
Connection	RS232 or RS485 cable
PC side	RS232 connection or RS232/USB converter RS485 connection or RS485/USB converter

USB connection via I-LB+ module
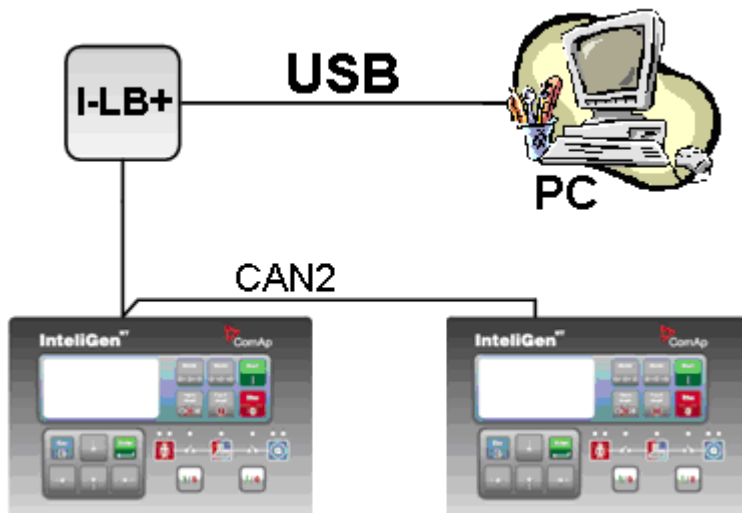
Hint:
I-LB+ module enables monitoring and configuration up to 32 controllers interconnected via CAN(2) intercontroller bus. It is also possible to use I-LB+ for single controller connection.

I-LB+ hardware setup

(**all jumpers in those positions**)

HW/SW control	no matter (Open)
ComAp/ModBus	Open
ADDR1/ADDR2	Selection of CAN address. Open = ADDR2, Close = ADDR1 (read more about I-LB+ module)
DIRECT/MODEM	Open
RS485/RS232	No matter
Comm. speed.	No matter
RS485 120 Ohm	Open = terminator not connected, Close = terminator connected
CAN 120 Ohm	Open = terminator not connected, Close = terminator connected
USB DISABLED/ENABLED	Close = USB is enabled

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	USB on I-LB+	USB on I-LB+	USB on I-LB+	USB on I-LB+	USB on I-LB+

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	USB on I-LB+	USB on I-LB+	USB on I-LB+	USB on I-LB+

Equipment

	Equipment needed
Controller side	I-LB+ unit
Connection	USB
PC side	USB connection

Ethernet connection via IB-NT (IG-IB)

Up to 32 controllers can be monitored via one IB-NT (IG-IB). Response time of a system with this type of connection depends on number of controllers, higher number of controllers means slower system response time.

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports / modules	IG-IB/IB-NT	IG-IB/IB-NT	IG-IB/IB-NT	IG-IB/IB-NT	IG-IB/IB-NT

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports / modules	IG-IB/IB-NT	IG-IB/IB-NT	IG-IB/IB-NT	IG-IB/IB-NT

NOTE:
Max. 3 clients of ComAp type (InteliDDE server, WinScope, WebSupervisor) can be connected simultaneously to the IB-NT (IG-IB).

Hint:
Get more information about IG-IB internet bridge. For more information about IB-NT internet bridge read ***IB-NT-2.0-Reference Guide.pdf***.

Ethernet connection (Direct)

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	ETHERNET	ETHERNET	-	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	NO	NO	NO
Available ports	-	-	-	-

Hint:
Ethernet connection is available for all mentioned controllers via external internet bridge IG-IB or IB-NT (see the chapter Ethernet connection IG-IB/IB-NT).

Number of clients connected simultaneously

2 clients with InteliMonitor or WebSupervisor (Comap/TCP protocol)
2 clients with web interface

Ethernet connection settings

Perform the connection settings the same way as for Single controller Ethernet connection.

NOTE:
The IP addresses of the controllers must be accessible from the remote computer. If the remote computer is connected into another LAN segment than the gen-sets are, there must be a gateway(s) that enable direct traffic between the segments. If the remote computer is connected via Internet, then the internet gateway of the LAN where gen-sets are connected must have public IP address, must allow incoming traffic and must provide port forwarding from the external public IP to the different internal gen-set IPs according to the port used.

INTERNET GATEWAY CONFIGURATION EXAMPLE (PORT FORWARDING)

Equipment

	Equipment needed
Controller side	-
Connection	Ethernet cable to LAN, for point to point connection between PC and controller use cross-wired cable
PC side	ETHERNET connection

Monitoring Local on site - MODBUS

ModBus - Single gen-set

RS232 ModBus

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	RS232(1)	RS232(1)	RS232(1)	RS232(1)	RS232(1)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS232(1)	RS232(1) RS232(2)	RS232(1) RS232(2)	RS232(1)

Hint:
Other way how to realize RS232 connection is via external bridge I-LB+.

Controller setup

(**Setpoints/Comms settings** group)

RS232(1 or 2) mode = MODBUS-DIRECT
RS485(1 or 2) conv. = DISABLED
RS232(1)MBCSpd = 9600, 19200, 38400, 57600

Equipment

	Equipment needed
Controller side	-
Connection	RS232 cable up to 10 m
Other device side	RS232 connection or RS232/USB converter

RS485 ModBus

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	RS485(2)	RS485(2)	-	RS485(2)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS485(1)	RS485(1) RS485(2)	RS485(2)	RS485(1)

Hint:
Some controllers do not allowe direct RS485 connection, however RS485 connection is available for all mentioned controllers via external bridge I-LB+.

Controller setup

(**Setpoints/Comms settings** group)

RS232(2) mode = MODBUS-DIRECT
RS485(2) conv. = ENABLED
RS232(2)MBCSpd = 9600, 19200, 38400, 57600

Equipment

	Equipment needed
Controller side	-
Connection	RS485 cable
Other device side	RS485 connection or RS485/USB converter

Ethernet - MODBUS/TCP (Direct)

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	ETHERNET	ETHERNET	-	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	NO	NO	NO
Available ports	-	-	-	-

Hint:
Ethernet Modbus/TCP connection is available for all mentioned controllers via external internet bridge IB-NT (see the chapter Ethernet – MODBUS (IB-NT)).

Number of clients connected simultaneously

1 client ModBus TCP/IP

Ethernet connection settings

Perform the connection settings the same way as for Single controller Ethernet connection.

Modbus/TCP access code

Every Modbus/TCP session has to be started with writing the access code from the modbus/tcp client to the controller. If the session is closed and reopened again the access code must be written again. The session can be closed by the client or the controller closes the session automatically if there is no activity from the client side for 15s.

- There are new dedicated registers for entering the AccessCode via Modbus/TCP.
- The register numbers are 46339-46346 (register address 6338-6345).
- The previous method using register address 24535 remains working as well.
- Example of the Modbus message is following (in HEX):

01 10 18 C2 00 08 10 30 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 FE F3

01	Controller address
10	Modbus function (16dec – Write multiple registers)
18C2	Register address (18C2hex = 6338dec = register 46339)
0008	Number of registers
10	Length of the data (Number of registers x 2B)
30000000...	Access code string (16 chars, null-terminated, ASCII, here "0")
FEF3	CRC

Some devices do not support the modbus function 16. In this case can be the access code writen in controller as one register No. 46339 using the function 6. The access code has to be the number in the range 0 to 65535.

Equipment

	Equipment needed
Controller side	-
Connection	Ethernet cable to LAN, for point to point connection between PC and controller use cross-wired cable
PC side	ETHERNET connection

For more informations about ModBus implementation to ComAp controllers read the chapter ModBus communication.

ModBus - Multiple gen-sets

RS485 – MODBUS

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	RS485(2)	RS485(2)	-	RS485(2)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	YES	YES	NO
Available ports	RS485(1)	RS485(1) RS485(2)	RS485(2)	-

Controller setup

(**Setpoints/Comms settings** group)

RS232(2) mode = MODBUS-DIRECT
RS485(2) conv. = ENABLED
RS232(2)MBCSpd = 9600, 19200, 38400, 57600

Equipment

	Equipment needed
Controller side	-
Connection	RS485 cable - Twisted pair, length up to 1 km
Other device side	RS485 connection or RS485/RS232 or USB converter

RS232/RS485 – MODBUS (I-LB+)

I-LB+ hardware setup

(**all jumpers in those positions**)

HW/SW control	No matter
ComAp/ModBus	Close
ADDR1/ADDR2	Selection of CAN address. Open = ADDR1, Close = ADDR2 It is possible to use up to two I-LB+ devices in direct mode on CAN(2) bus. Let jumper open in case of using one I-LB+ module. Other I-LB module has to have this jumper closed. (read more about I-LB+ module)
DIRECT/MODEM	No matter
RS485/RS232	Selection of communication port (jumper is in RS232 or RS485 position)
Comm. speed.	Selection of communication speed by jumpers P13, P14 to 9600, 19200, 38400, 57600 bps
RS485 120 Ohm	Open = terminator not connected, Close = terminator connected
CAN 120 Ohm	Open = terminator not connected, Close = terminator connected
USB DISABLED/ENABLED	No matter

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	YES	YES	NO
Available ports	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+	RS232 on I-LB+ RS485 on I-LB+

Equipment

	Equipment needed
Controller side	I-LB+ unit
Connection	RS232, RS485 cable
PC side	RS232 connection or RS232/USB converter RS485 connection or RS485/USB converter

Ethernet - MODBUS (IB-NT)

Up to 32 controllers can be monitored via one IG-IB. Response time of a system with this type of connection depends on number of controllers, higher number of controllers means slower system response time.
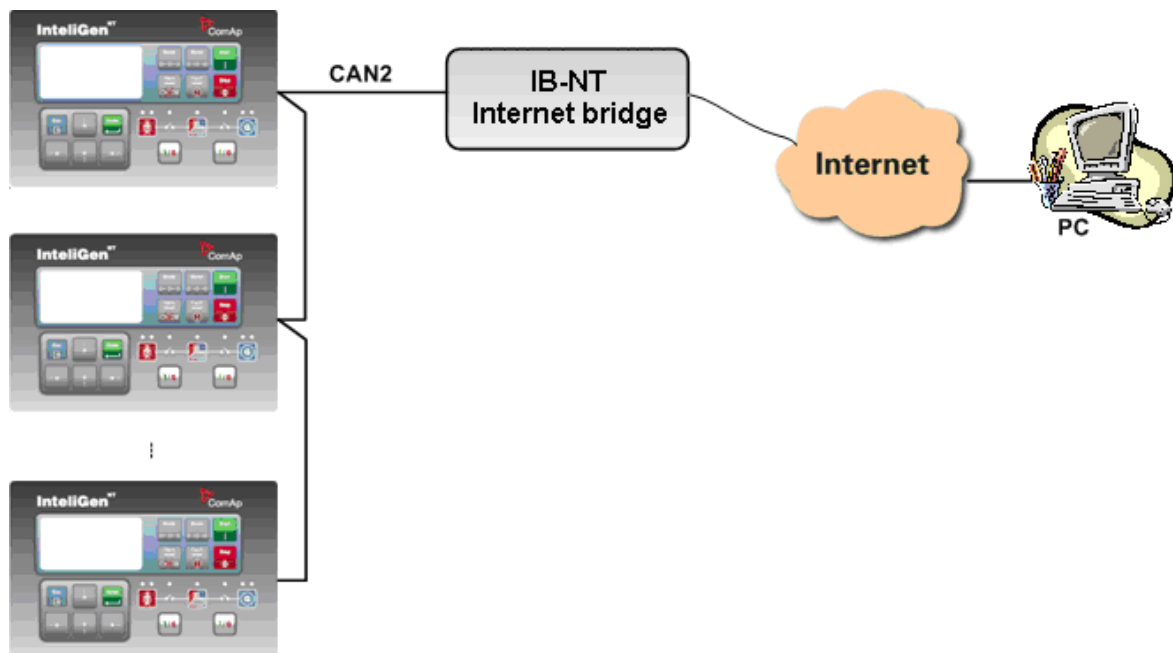
Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports / modules	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports / modules	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT

Hint:
For more information about IB-NT internet bridge read ***IB-NT-2.0-Reference Guide.pdf***.

Ethernet - MODBUS/TCP (Direct)

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	ETHERNET	ETHERNET	-	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	NO	NO	NO
Available ports	-	-	-	-

Hint:
Ethernet Modbus/TCP connection is available for all mentioned controllers via external internet bridge IB-NT (see the chapter Ethernet – MODBUS (IB-NT)).

Number of clients connected simultaneously

   1client ModBus TCP/IP

Ethernet connection settings

Perform the connection settings the same way as for Single controller Ethernet connection.
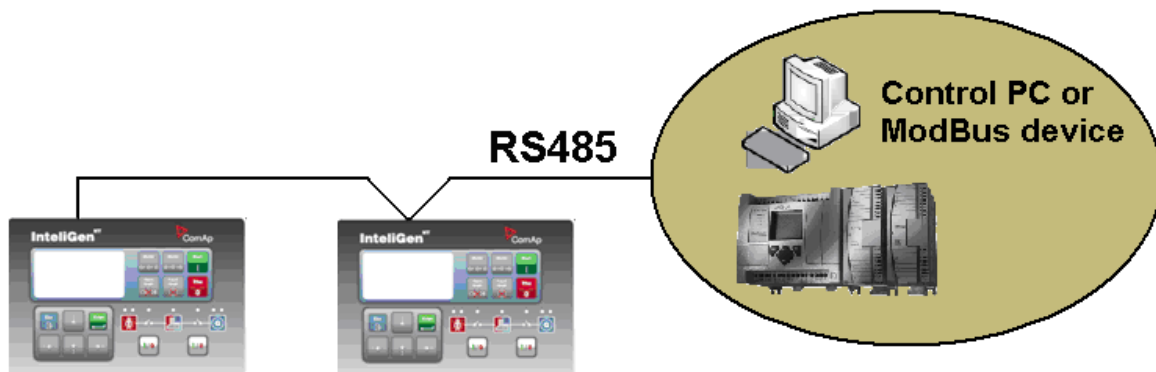
Equipment

	Equipment needed
Controller side	-
Connection	Ethernet cable to LAN, for point to point connection between PC and controller use cross-wired cable
PC side	ETHERNET connection

For more informations about ModBus implementation to ComAp controllers read the chapter ModBus communication.

Remote monitoring

Connection to Internet (Direct)

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	-	ETHERNET	ETHERNET	-	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	NO	NO	NO
Available ports	-	-	-	-

Hint:
Internet connection is available for all mentioned controllers via external bridge IG-IB or IB-NT (see the chapter Ethernet connection via IG-IB/IB-NT).

Number of clients connected simultaneously

2 clients with InteliMonitor or WebSupervisor (Comap/TCP protocol)
1 client Modbus/TCP
2 clients with web interface

Ethernet connection settings

Perform the connection settings the same way as for Single controller Ethernet connection.

How to open Internet connection in InteliMonitor?

Use the same procedure as well as for Multiple gen-sets Ethernet connection.

Using a web browser

Ethernet connection to controller makes possible using any web browser for basic monitoring and adjustment of the controller. Simply put the IP address of the module into the address line in your web browser like `http://192.168.1.254` and then enter access code. In case of connection from web browser there is 5 minutes timeout after closing the browser window. After that the client is automatically logged out.

> **NOTE:**
> The IP addresses of the controllers must be accessible from the remote computer. If the remote computer is connected into another LAN segment than the gen-sets are, there must be a gateway(s) that enable direct traffic between the segments. If the remote computer is connected via Internet, then the internet gateway of the LAN where gen-sets are connected must have public IP address, must allow incoming traffic and must provide port forwarding from the external public IP to the different internal gen-set IPs according to the port used.

INTERNET GATEWAY CONFIGURATION EXAMPLE (PORT FORWARDING)

Equipment

	Equipment needed
Controller side	-
Connection	Ethernet cable to LAN, for point to point connection between PC and controller use cross-wired cable
PC side	ETHERNET connection

Available software for IG/IS-NT

Software	GenConfig	InteliMonitor	WinScope
Applicable	YES	YES	YES

Internet connection via AirGate

This connection type is used for connection to controllers/sites, that are connected to the Internet, however they do not have public and static IP address. The controllers connect by themselves to the AirGate server and cyclically ask whether there is a connection request from a client or not. On the other side the clients (InteliMonitor, WebSupervisor) connect to the AirGate server instead of connecting directly to the controller. The server then creates a "tunnel" between the client and the controller. Internet connection via AirGate server is supported by controllers IG-NTC-BB and IS-NTC-BB with ethernet connection possibility. The connection to ethernet is realized the same way as remote ethernet connection.

CAUTION!
To avoid unauthorized access to the controller change the access code and keep it secret!
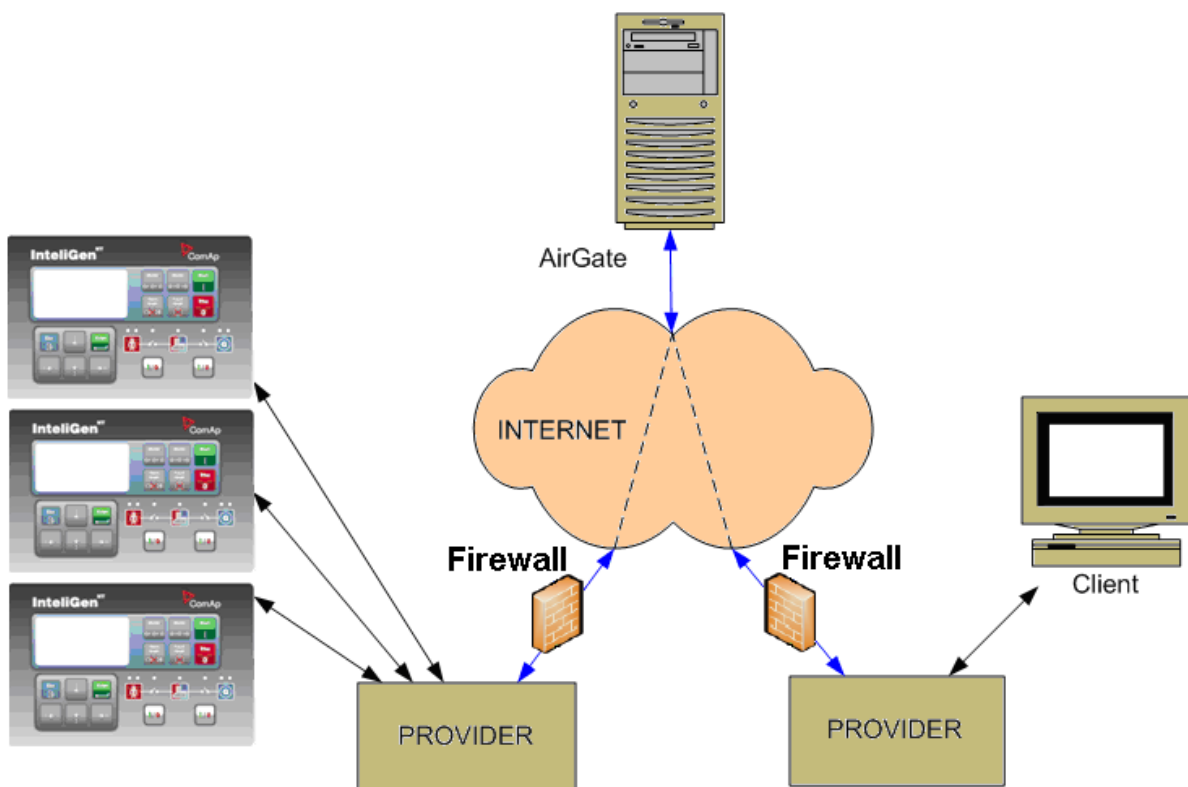
PRINCIPLE OF AIRGATE CONNECTION

Airgate connection settings

Parameters can be set via any type of connection (USB, RS232, Ethernet). Setup is provided via InteliMonitor. For ethernet connection set these parameters in *Comms Settings* group:

		1	2	3	4	5	6	7	
IP addr mode	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	AUTOMATIC ▼
IP address	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	192.168.1.254
Net mask	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	255.255.255.0
Gateway IP	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	192.168.1.1
ComApProtoPort	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	23
AirGate	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ENABLED ▼
AirGate IP	0 ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	airgate.comap.cz

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	NO	YES	YES	NO	YES
Available ports	external bridge IB-NT	ETHERNET	ETHERNET	external bridge IB-NT	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	NO	NO	NO	NO
Available ports	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT

CAUTION!
Connection via AirGate is supported by controllers with direct connection to LAN only or via IB-NT module. Airgate connection is not available for connection via IG-IB module.

Connection to InteliMonitor via AirGate server

1. Select the AirGate connection type.
2. Fill-in the correct AirGate ID for each controller.
3. Enter the AirGate server address.

Hint:
You will obtain the AirGate ID by the registration of the particular controller on the AirGate server. Set all setpoints in *Comms Settings* group according to AirGate connecgtion settings and connect controller to LAN. Controller AirGate ID will be viewed on the screen.
NOTE:
This function is available in InteliMonitor ver. 2.6 and higher. Please watch the ComAp web site for detailed information.
NOTE:
Although the controllers in your site are not connected together by the CAN2 bus they must have different controller addresses.
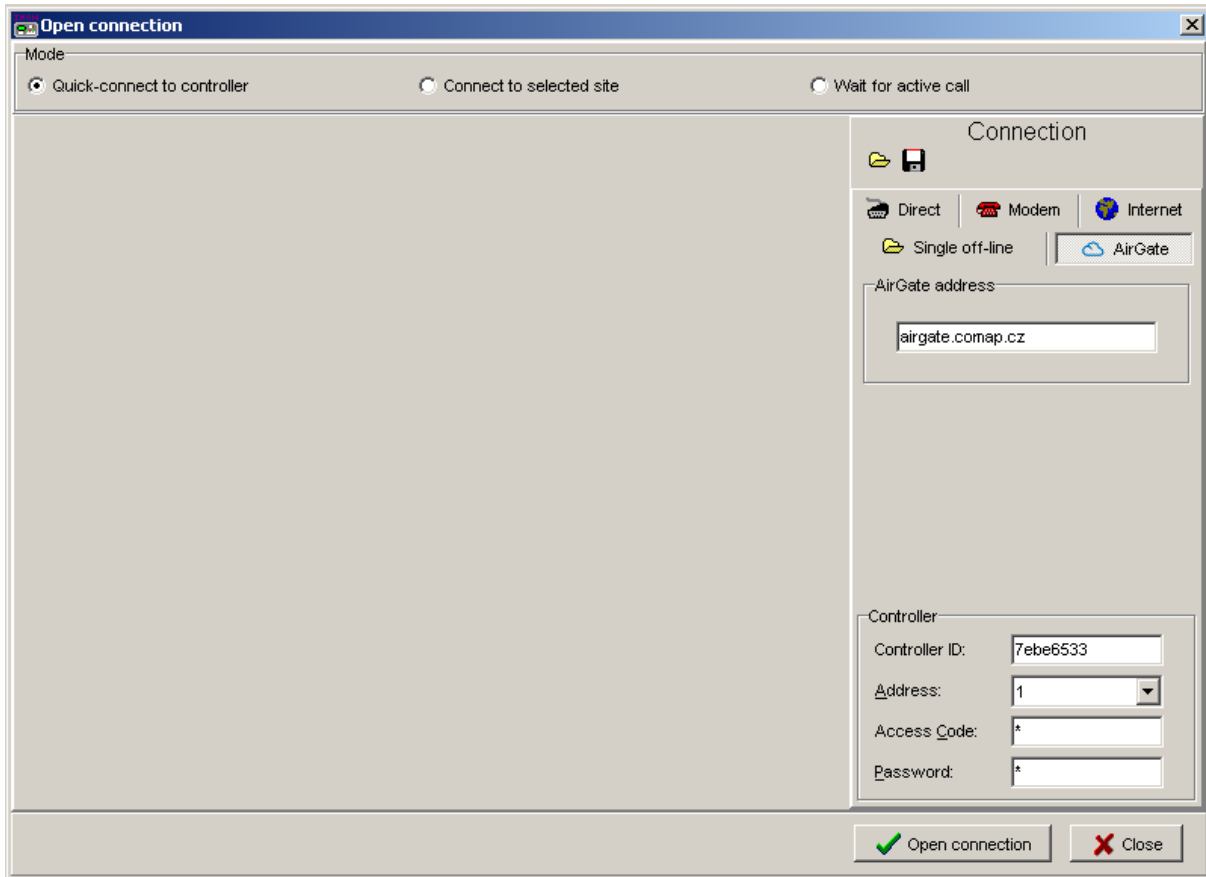
AIRGATE CONNECTION SETTINGS

WebSupervisor

WebSupervisor is web based system designed for monitoring and controlling ComAp controllers via the internet. This system offers a number of beneficial features that help optimize revenue for machinery fleets, as each piece of equipment can be individually monitored for all important operation values.

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	external bridge IB-NT	ETHERNET	ETHERNET	external bridge IB-NT	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT	external bridge IB-NT

WebSupervisor connection settings

Connection of controllers with direct Ethernet port can be realized two diferent ways:
1. **Internet connection via AirGate:** No fixed and public IP address is needed. Connect and set the controller the same way as for Internet connection via AirGate.
2. **Internet connection without AirgGate:** Controller has to have fixed and public IP address. Connect and set the controller the same way as for Ethernet Connection (Direct).

Connection of all controllers can be realized using IG-IB external bridge. Connect and set the controller the same way as for Ethernet (Internet) connection via IG-IB module.

First Steps
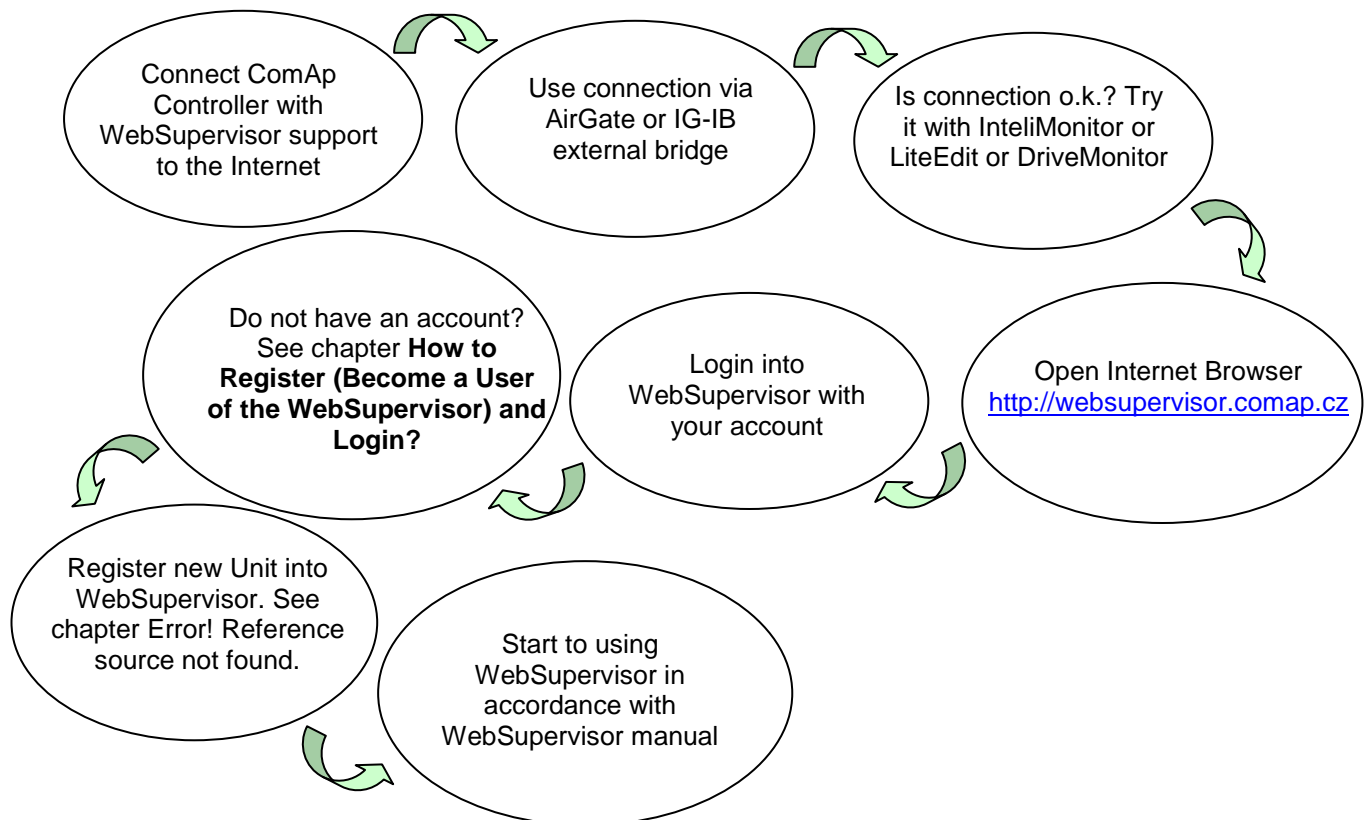
Start to using

How to Register (Become a User of the WebSupervisor) and Login?
You can start using WebSupervisor without installation any special software on your PC.
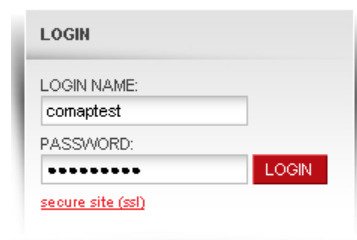
To start and login into WebSupervisor:

1. Open http://websupervisor.comap.cz/ in your browser.
   The WebSupervisor homepage appears:
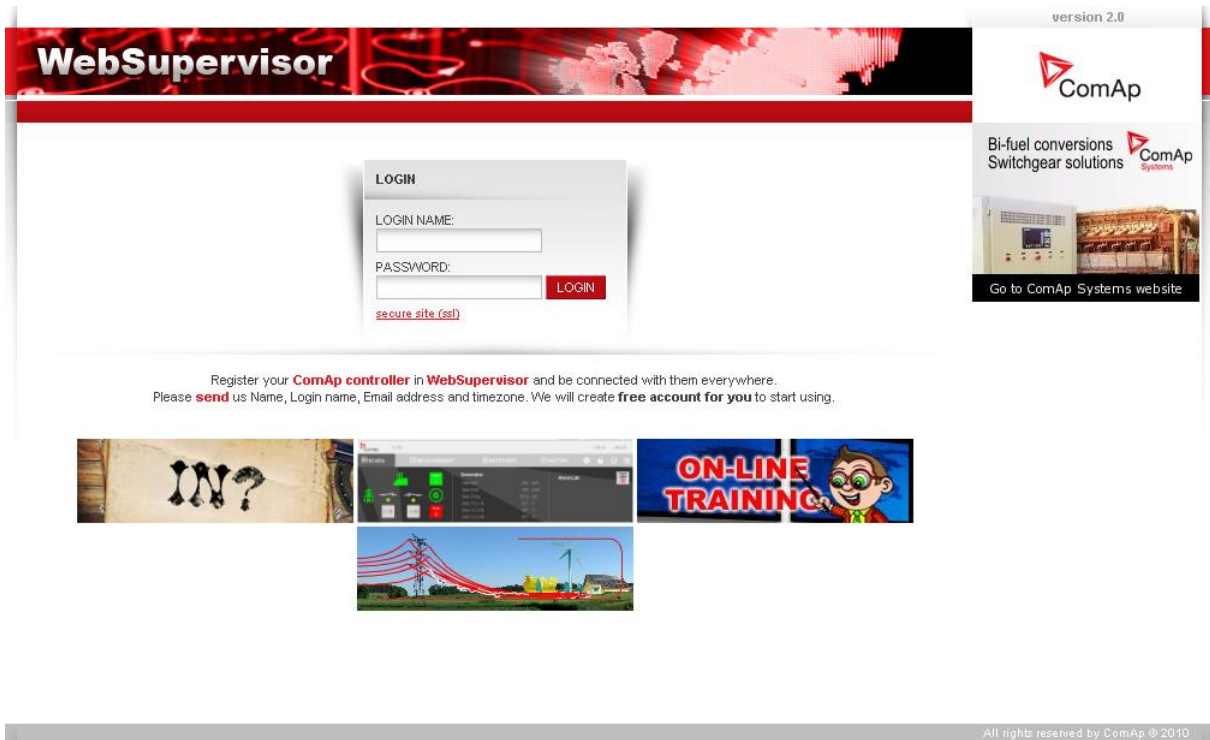
2. Insert your login name and password into field **LOGIN NAME** and **PASSWORD**, see below.

   If you have not created an access, please send email to admin.websupervisor@comap.cz. Please send us Name, Login name, Email address and Timezone. We will create free account for you to start using it.

More information about WebSupervisor you can get in *WebSupervisor-2_0 Reference Guide.pdf*.

Web interface

The web interface is intended to monitor the controller from a web browser. Static IP address is required for this function as you must know the IP address to put it into the browser. Public IP address or port forwarding is required if you want to see the web pages from the Internet.
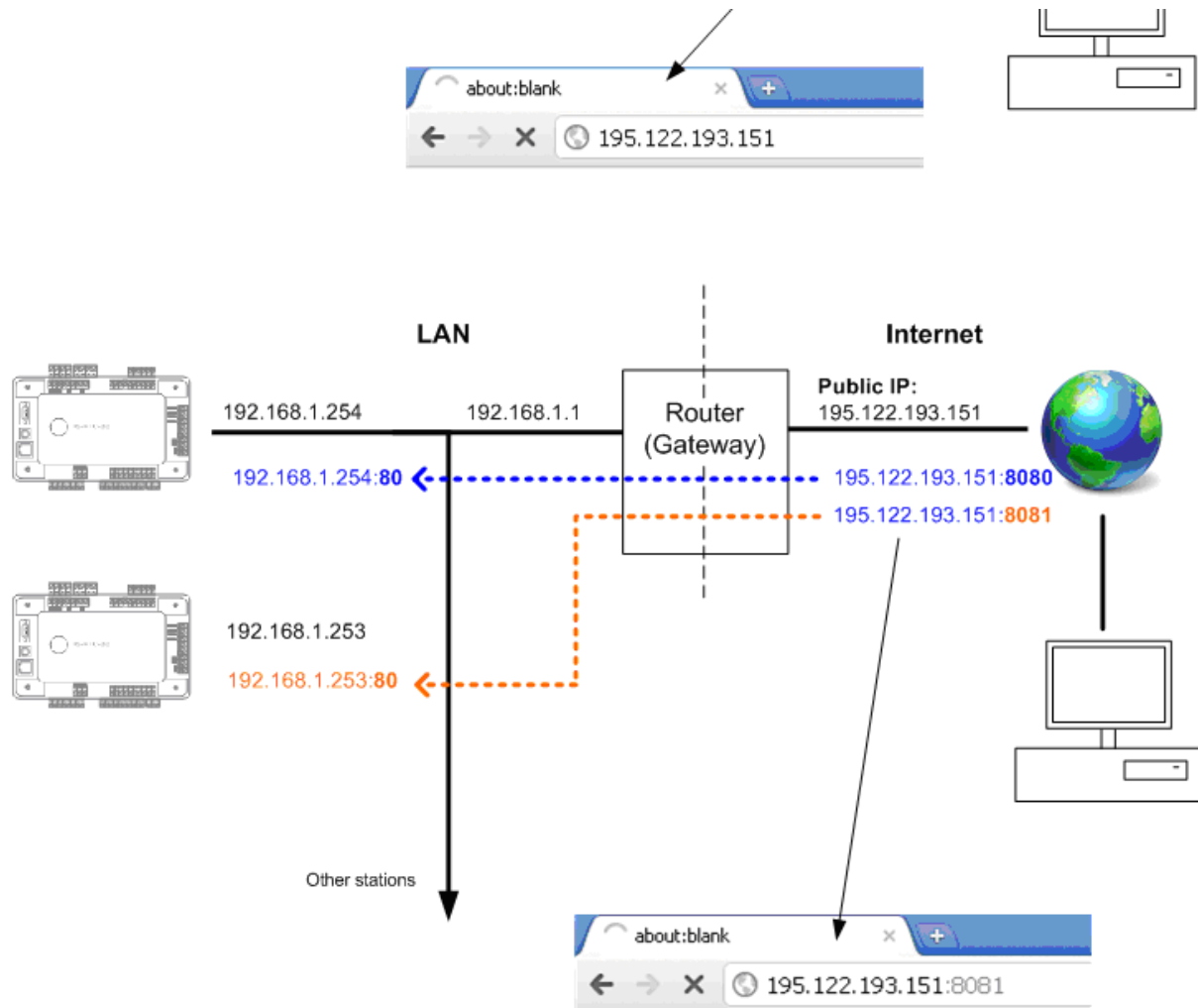
PORT FORWARDING EXAMPLE FOR WEB CONNECTION

The web server is designed for basic monitoring and adjustment of the controller using a web browser. Put the Controller IP address into the browser. You will be asked for the **controller access code** prior to entering the controller web.

NOTE:
The web server is optimized for IE6 or higher and screen resolution 1024x768 pixels.

CAUTION!
Do not use the browser navigation buttons as "Back", "Forward" or "Reload". Use the links and the reload button located in the toolbar instead.

Scada

Click to the SCADA link in the toolbar to display the scada page. The scada page is also the main page which is displayed by default if you just put the controller address into the browser.

NOTE:
The scada page layout may differ according to the firmware branch, version and application. Certain old firmware versions does not support web access at all.
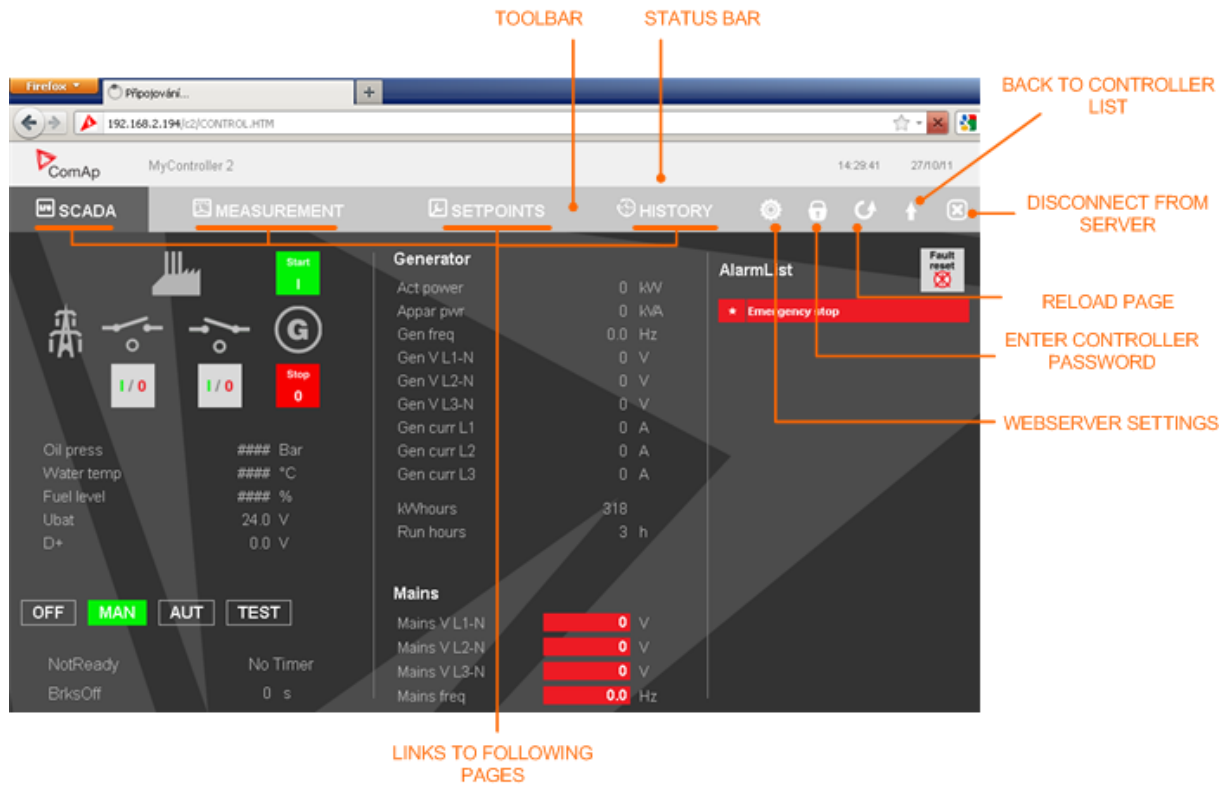
Measurement

Click to the MEASUREMENT link in the toolbar to display the measurement page. Then click to the required group name in the left box to display values of the group in the right box.

NOTE:
The measurement page is automatically refreshed every 60 seconds.
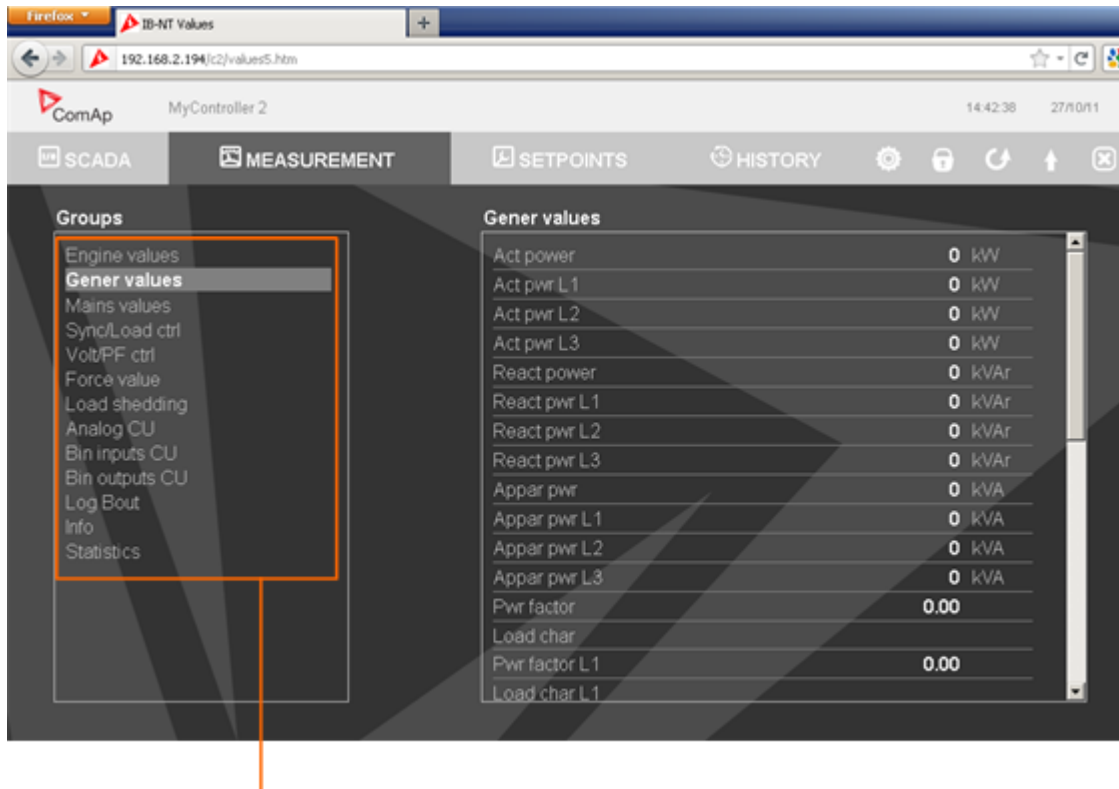
LINKS TO THE GROUPS

Setpoints

- Click to the SETPOINTS link in the toolbar to display the setpoints page.
- Click to the required group name in the left box to display setpoints of the group in the right box.
- Click to the required setpoint name or value to change the value. If the respective setpoint is protected by password, which is indicated by a lock icon by the setpoint name, you have to click on the "Controller password" icon located in the toolbar and then enter valid password.

NOTE:
The setpoint page is automatically refreshed every 60 seconds. If an another user changes a setpoint from other terminal, the web page will not show this change immediately as e.g. InteliMonitor.

PASSWORD REQUIRED

LINKS TO THE GROUPS

LINKS TO THE SETPOINTS CHANGE

GO BACK WITHOUT CHANGING THE SETPOINT

CONFIRM CHANGE
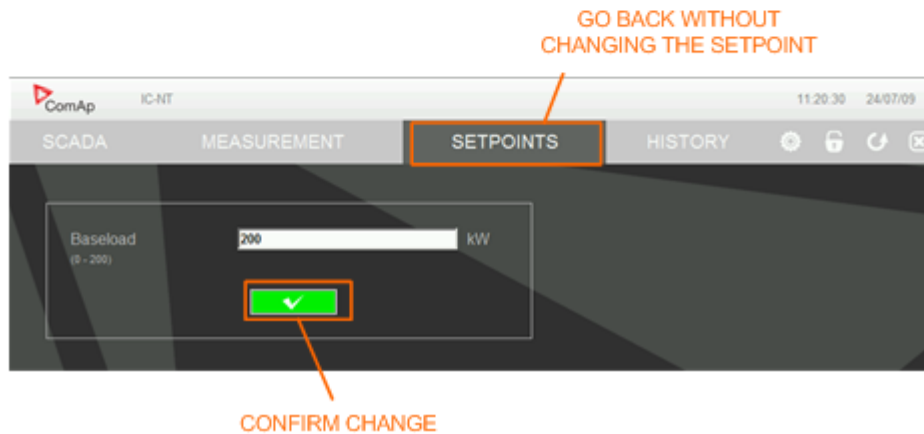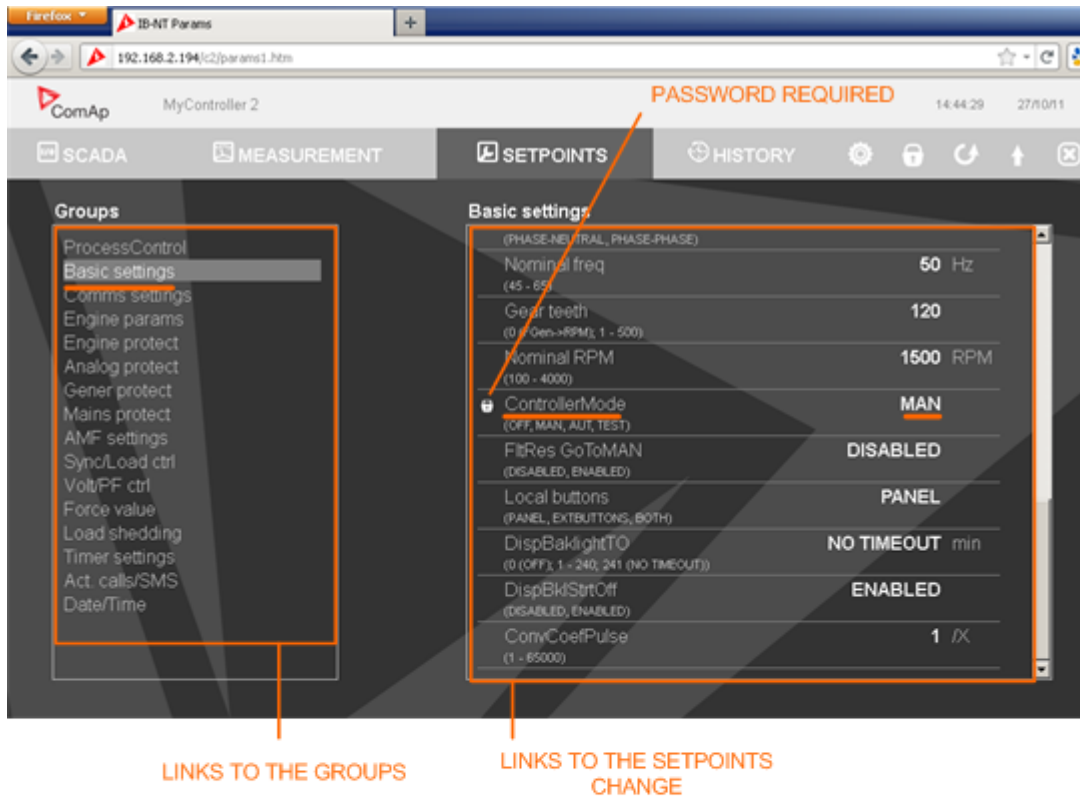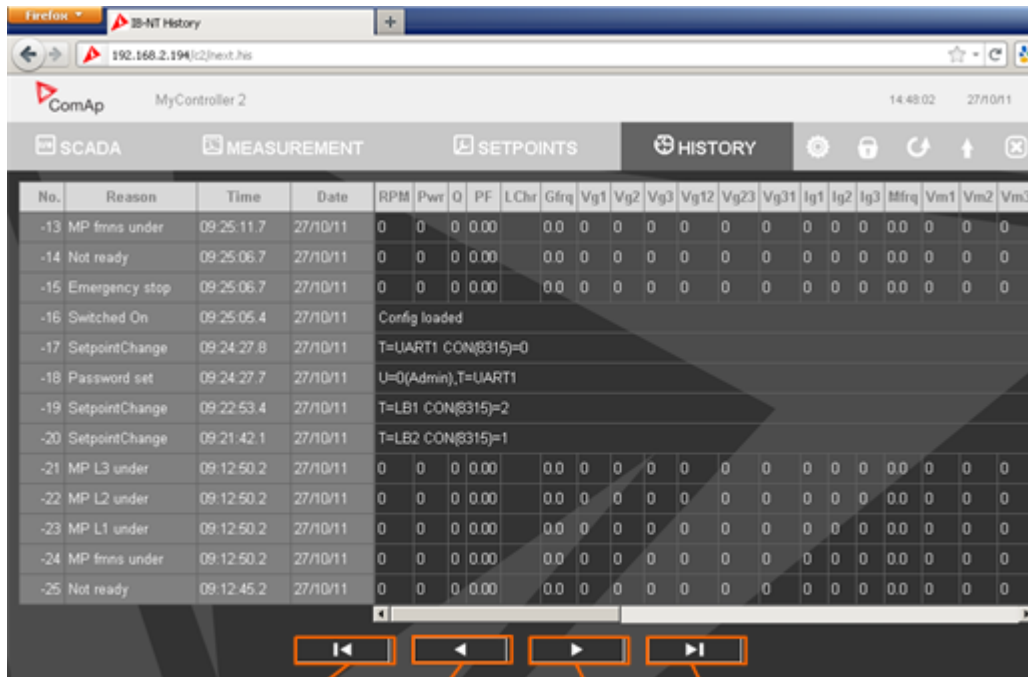
History

- Click to the HISTORY link in the toolbar to display the history page.
- Use the control buttons to move within the history file.

NOTE:
The history page is automatically refreshed every 5 minutes. If a new record appears in the controller, the web page will not show it immediately as e.g. InteliMonitor.

FIRST PAGE (most recent)   PREVIOUS PAGE (more recent)   NEXT PAGE (older)   LAST PAGE (most old)

Web server adjustment

- Click to the "Webserver settings" icon in the toolbar to display the settings page.
- Select the controller language the web pages will appear in.
- Select the rate of automatic refresh of the scada page.

Internet connection via cellular network

Connection via Internet bridge IB-NT

What is InternetBridge-NT?

InternetBridge-NT is a communication module that allows connection of a single controller as well as whole site to the Internet or Local area network. The connection to the Internet can be via built-in cellular modem supporting 2G and 3G networks or Ethernet cable.

The module can be used for controllers from following product lines: IG-NT, IS-NT and IC-NT.

NOTE:
For proper operation it is necessary to update the controller firmware to a version which supports IB-NT. For IG-NT and IS-NT standard branch the first version supporting IB-NT is 2.6.
For more information about IB-NT read *IB-NT-2.0-Reference Guide.pdf*.

Features

- Direct ethernet connection to ComAp PC programs
- AirGate® support
- SMTP protocol for sending of active emails from the controller
- HTTP protocol for web-based monitoring and adjustment
- MODBUS/TCP server
- SNMP protocol

Modem connection

Modem connection to Single gen-set

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	RS232(1)	RS232(1)	RS232(1)	RS232(1)	RS232(1)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS232(1)	RS232(1) RS232(2)	RS232(1) RS232(2)	RS232(1)

Hint:
Other way how to realize modem connection is via external bridge I-LB+.

Controller setup

(Setpoints/Comms settings group)

RS232(1,2) mode = MODEM (HW) / MODEM (SW)
RS485(1,2) conv. = DISABLED

Equipment

	Equipment needed
Controller side	Analog, ISDN or GSM modem
Connection	Phone line or GSM
PC side	Analog, ISDN or GSM modem

Hint:
For appropriate function is the same type of modem on both sides needed. Use of combination of analog and GSM modem is not recommended.

Modem connection to Multiple gen-sets

Hint:
I-LB+ module enables monitoring and configuration up to 32 controllers interconnected via CAN(2) intercontroller bus. It is also possible to use I-LB+ for single controller connection.

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	RS232 on I-LB+	RS232 on I-LB+	RS232 on I-LB+	RS232 on I-LB+	RS232 on I-LB+

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	RS232 on I-LB+	RS232 on I-LB+	RS232 on I-LB+	RS232 on I-LB+

Controller setup

(Setpoints/Comms settings group)

CANAddrSwitch 1/CANAddrSwitch 2 = MODEM

I-LB+ hardware setup

(**all jumpers in those positions**)

HW/SW control	According HW or SW control of modem
ComAp/ModBus	Open
ADDR1/ADDR2	Selection of CAN address. Open = ADDR1, Close = ADDR2 It is possible to use up to two I-LB+ devices in modem mode on CAN(2) bus. Let jumper open in case of using one I-LB+ module. Other I-LB module has to have this jumper closed. (read more about I-LB+ module)
DIRECT/MODEM	Close
RS485/RS232	Set jumper to RS232 position
Comm. speed.	No matter
RS485 120 Ohm	Open = terminator not connected, Close = terminator connected
CAN 120 Ohm	Open = terminator not connected, Close = terminator connected
USB DIASABLED/ENABLED	No matter

Equipment

	Equipment needed
Controller side	I-LB+ unit, Analog, ISDN or GSM modem
Connection	Phone line or GSM
PC side	Analog, ISDN or GSM modem

Active Call

Function

When active calls are activated for alarms on site (warning, shut-down…) the controller calls to the preselected telephone number and sends the ANT archive file.
Software (e.g. InteliMonitor) on the PC side must be running and waiting for active call.

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES

Hint:
Active call uses for communication the modem connection.

Equipment

The same as for modem connection

Controller setup

(**Setpoints/Comms settings** group)

Act. calls/SMS: *AcallCH1(-3)-Type* = DATA
Act. calls/SMS: *AcallCH1(-3)-Addr* = telephone number

Active SMS
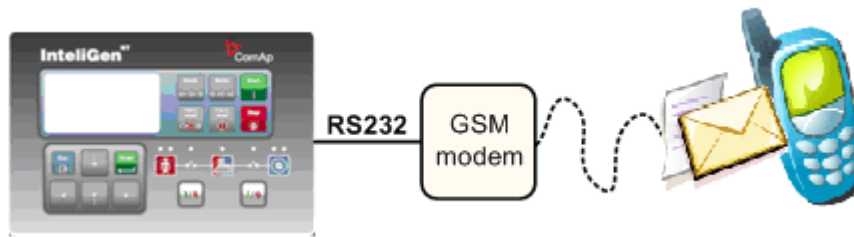
Function

When SMS active calls are activated for alarms on site (warning, shut-down…) the controller sends SMS message to the predefined GSM number.

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES

Hint:
Active SMS uses for communication the modem connection.

Equipment

	Equipment needed
Controller side	GSM Modem or I-LB + GSM Modem
Connection	GSM
PC side	GSM Mobile Phone

Controller setup

(**Setpoints/Comms settings** group)

Act. Calls/SMS: *AcallCH1(-3)-Type* = SMS
Act. calls/SMS: *AcallCH1(-3)-Addr* = mobil phone number
Act. calls/Acall+SMS lang: *AcallCH1(-3)-Addr* = 1, 2, 3, ...

Hint:
Maximum length of SMS sent in not default language is 70 characters. Number of language corresponds with number of language in GenConfig (card "Languages").

Example

SMS in format

```
#Gen-set name:AL=(Wrn PrimWater temp, !Emergency stop)
```

is sent in case that the primary water temperature exceeded the warning limit and Emergency stop input has been deactivated.

Active E-mail (SMS E-mail)

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Available ports	external bridge IB-NT	ETHERNET	ETHERNET	external bridge IB-NT	ETHERNET

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Available ports	external bridge IB-NT	ETHERNET	ETHERNET	external bridge IB-NT

Equipment

	Equipment needed
Controller side	Ethernet connection
Connection	Internet
PC side	Ethernet connection, e-mail message box

Function

When active e-mails are activated for alarms on site (warning, shut-down…) the controller sends e-mail message to the predefined e-mail address. The function and settings for Direct Ethernet port connection and connection via external bridge IG-IB are the same.

Controller setup

(**Setpoints/Comms settings** group)

Act. calls/SMS: *AcallCH1(-3)-Type* = IB-E-MAIL
Act. calls/SMS: *AcallCH1(-3)-Addr* = email address (maximum length of email address is 31 characters)
Act. calls/Acall+SMS lang: *AcallCH1(-3)-Addr* = 1, 2, 3, ...

Hint:
Number of language corresponds with number of language in GenConfig (card "Languages").

Peripheral modules

Displays

InteliVision 8 display

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Physical port	RS485 (1), CAN(2)	RS485 (1), CAN(2)	RS485 (1), CAN(2)	RS485 (1), CAN(2)	RS485 (1), CAN(2)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Physical port	RS485 (1), CAN(2)	RS485 (1), CAN(2)	RS485 (1), CAN(2)	RS485 (1), CAN(2)

It is possible to connect up to 3 IV8 displays to RS485(1) terminal Link and up to 2 displays on CAN(2) bus.

Hint:
Connection InteliVision 8 to IG/IS-NT controllers is described in InteliVision-1.2.2-Reference Guide.pdf

Attention:
In case of connection IV8 to controller via CAN(2) bus the collision can occur. IV8 is in this case connected via 123 and 124 CAN (2) physical address, that can be used for other peripheral modules (see the table bellow). Make sure, that real CAN(2) physical address (123 and 124) are not shared by other devices such as I-LB+ module.

Real CAN2 Address	IG-MU	I-LB (local) (RS232/485)	I-LB (modem)	I-LB+ (USB)	IG-IB (IBConfig ≤ 1.5)	IG-IB (IBConfig ≥ 1.6)	IV-DISPLAY*	I-RD-CAN
122			addr. 2					
123	addr. 2	addr. 2		addr. 1	addr. 1	addr. 2	addr. 2	addr. 2
124	addr. 1	addr.1		addr. 2	addr. 2	addr. 1	addr. 1	addr. 1
125	modem		addr. 1					

Controller setup

(Setpoints/Comms settings group)

RS485(1) conv. = DISABLED

InteliVision 5 display

Controllers

Controllers	IG-NT-BB	IG-NTC-BB	IS-NTC-BB	IM-NT-BB	IM-NTC-BB
Connection applicable	YES	YES	YES	YES	YES
Physical port	RS485 (1)	RS485 (1)	RS485 (1)	RS485 (1)	RS485 (1)

Controllers	IG-NT	IG-NTC	IS-NT-BB	IM-NT
Connection applicable	YES	YES	YES	YES
Physical port	RS485 (1)	RS485 (1)	RS485 (1)	RS485 (1)

It is possible to connect up to 3 InteliVision 5 displays to RS485(1) terminal Link.

Hint:
Connection InteliVision 5 to IG/IS-NT controllers is described in InteliVision 5 Reference Guide.pdf

Controller setup

(Setpoints/Comms settings group)

RS485(1) conv. = DISABLED

Comms extension - I-LB+ Local bridge

Description

I-LB+ is communication modules for communication with all devices connected to CAN(2) bus. I-LB+ is successors of the IG-MU unit designed to be used with IG/IS controllers. It therefore provides additional communication port and higher communication speed. Speed for direct/modem connection can be up to 57600 bps (IG-MU only 19200 bps). I-LB / I-LB+ can be connected with PC via USB, RS232 or RS485. I-LB is without USB port, I-LB+ is with USB port (speed ≈ 115200 bps).
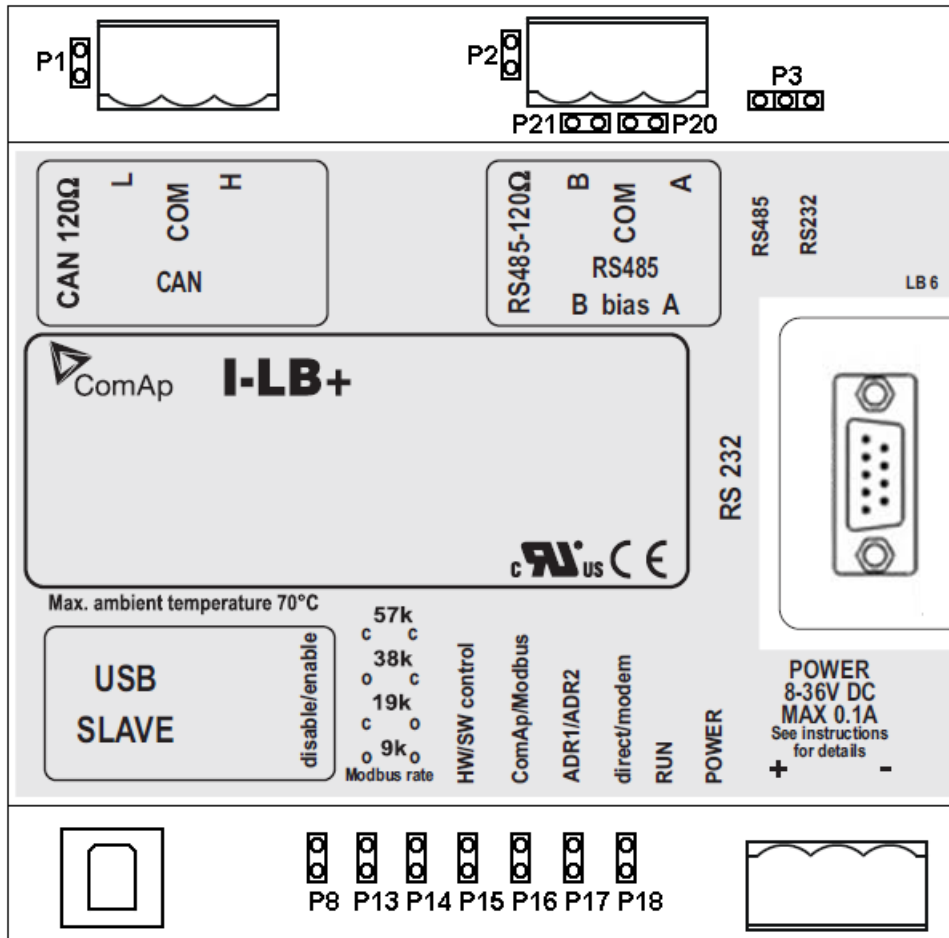
Jumper setings:

Jumper	Description	State
P1	CAN terminating resistor	Opened – not connect
P2	RS485 terminating resistor	Opened – not connect
P3	RS232 or RS485	1–2 – active RS485
P8	USB enable/disable	Opened – disabled
P13	Modbus rate	9600, 19200, 38400, 57600 bps (according to picture: O = Open, C = Close.
P14	Modbus rate	
P15	HW or SW modem control	Opened – HW control
P16	ComAp or Modbus	Opened – ComAp protocol
P17	ADR1 or ADR2	Opened – ADR1
P18	Direct or Modem	Opened – Direct

According Addr.1/Addr.2 setings real CAN address is assigned to port.

	RS232/485 DIRECT	MODEM	USB
Addr. 1	124	125	123
Addr. 2	123	122	124

It is possible to use those combinations simultaneously:

- 2x direct RS232/RS485 and 2x MODEM (USB communication has to be disabled, P8 is opened)

- 1x USB and 1x RS232/RS485

Jumper selection tree

ComAp / ModBus – selects between ComAp PC tools (InteliMonitor, WinScope, ...) and third party PC SW for monitoring:

- **ComAp**
    - o **Direct / Modem** – selects between direct connection (via RS232 or RS485) and modem connection type
        - **DIRECT**
            - **RS232 / RS485** – selection of serial communication type
            - **ADR1 / ADR2** – selection between two available local communication channels; if I-LB+ is used, the USB communication automatically occupies the other channel
        - **MODEM**
            - **HW / SW control** – selection between modems with full interface
            - **ADR1 / ADR2** – selection between two available modem communication channels; IG/IS-NT controllers only, in ID the secondary modem channel not available
            - Setting **RS232 / RS485** jumper to RS232 position is obligatory

- **ModBus (not available at USB port of I-LB+, USB port always works in ComAp mode)**
    - o **Direct / Modem** – selects between direct connection (via RS232 or RS485) and modem connection type
        - **DIRECT**
            - **RS232 / RS485** – selection of serial communication type
            - **ADR1 / ADR2** – selection between two available local communication channels; if I-LB+ is used, the USB communication automatically occupies the other channel
        - **MODEM**
            - **ADR1 / ADR2** – selection between two available modem communication channels; IG/IS-NT controllers only, in ID the secondary modem channel not available
            - Setting **HW / SW control** has no influence; a modem with HW control is always expected in this mode
    - o **ModBus Rate** (9600 / 19200 / 38400 / 57600 bps) – selects the communication speed when ModBus protocol is selected, no matter if in Direct or Modem mode

For more information read IGS-NT accessory modules manual.

Comms extension - IG-IB Internet Bridge

How to establish connection between the IG-IB and InteliMonitor

IP address of IG-IB needs to be set in InteliMonitor in this way if default port number 23 is used:
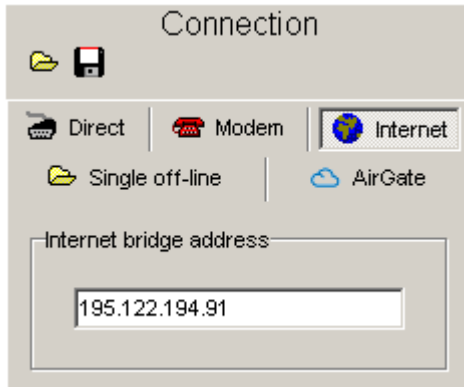
IP address of IG-IB needs to be set in InteliMonitor in this way if port number other than 23 is used:
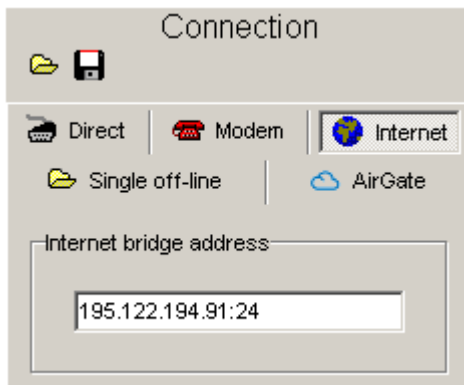
Internet Bridges IP's definition consist of two parts:
195.122.194.91 : 24
IP address   Port number

Several IG-IB's connection using RS232

Use the next type of internet connection for faster communication with more than 10 controllers
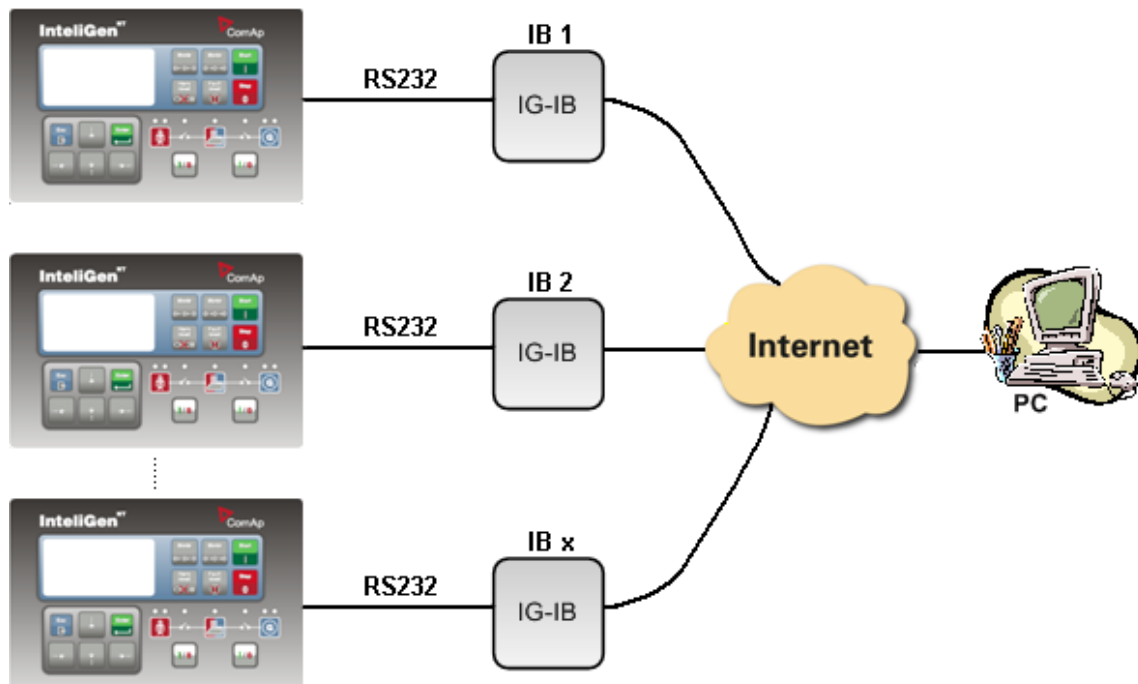
One IG-IB is connected to each controller via RS232 for faster communication. It means that up to 32 IG-IB's can be used on one site. Use this connection for communication with 10 or more controllers. Communication speed gain achieved with this connection is not significant for less than 10 controllers.

IP addresses of IG-IB's needs to be set in InteliMonitor in this way (if port number 24 is used instead of the default port 23):
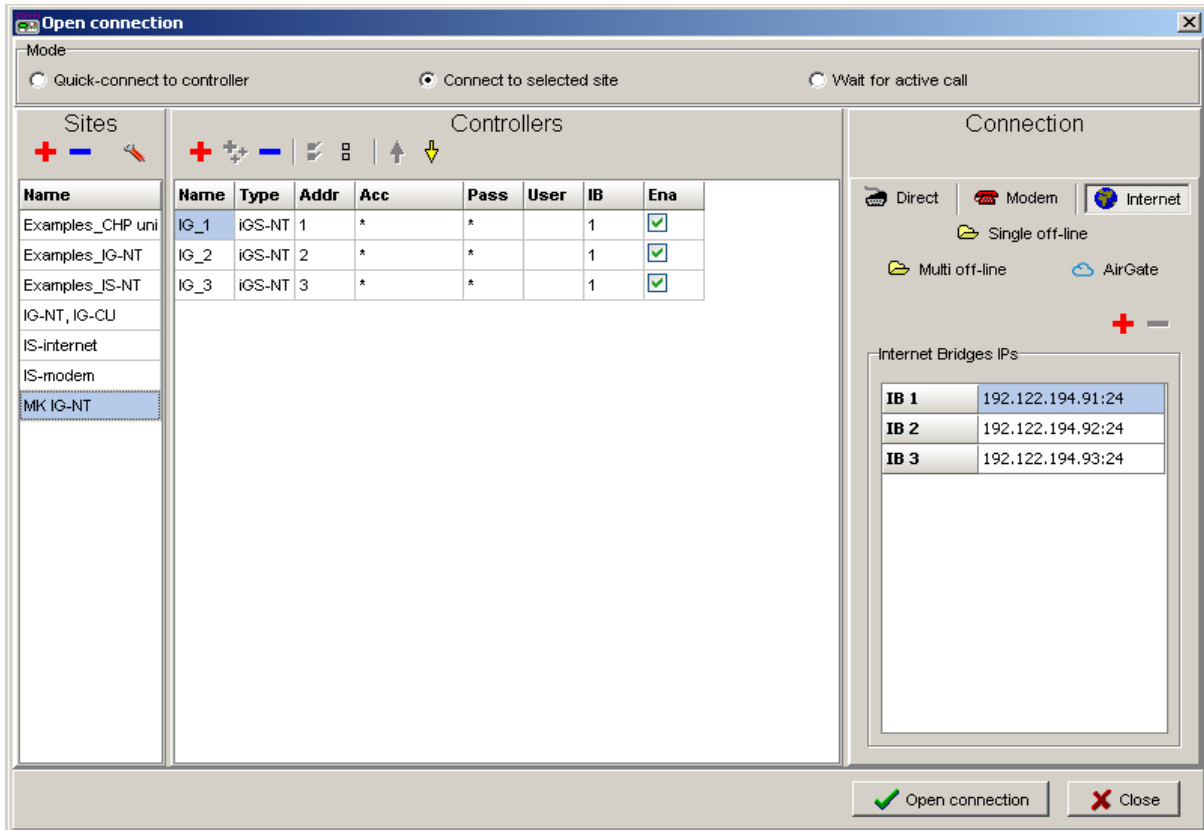
Internet Bridges IP's definition consist of two parts:

195.122.194.91 **:** 24
IP address   Port number

Equipment

	Equipment needed
Controller side	InternetBridge (IG-IB) unit configured for Ethernet connection (Ethernet connection firmware); Internet connection with "visible" IG-IB
Connection	Ethernet
PC side	Internet connection

Available software for IG/IS-NT

Software	GenConfig	InteliMonitor	Third party SW
Applicable	YES	YES	NO

PC Software features (GenConfig, InteliMonitor)

	On-line Genset control	Controller configuration	Read Genset values	Read history	Firmware programming	Archive files upload/download
GenConfig	-	X	-	-	X*	X
InteliMonitor	X	-	X	X	-	-

* Possible, but not recommended due to risk of crash of programming if the communication is lost.

Connection speed

Up to 3000 Bps

Hint:
IG-IB communication is typically faster than modem:
- when IG-IB is connected to controller via CAN and LAN - 3000 Bps
- when IG-IB is connected to controller via RS232 and LAN - 1200 Bps
- when IG-IB is connected to controller via CAN and Internet - ~500 Bps
- when IG-IB is connected to controller via RS232 and Internet - ~500 Bps (depends on the internet line throughput).

Connection from PC

For connection from PC see the manual of the PC program (InteliMonitor, etc.).
Open the Open/Select connection window and set:
- Internet type of connection
- Controller address
- Access code
- IG-IB IP address

Note that IP address you set can be different from the IP address of iG-IB (when the iG-IB IP address is not public). It depends on gateway setting:
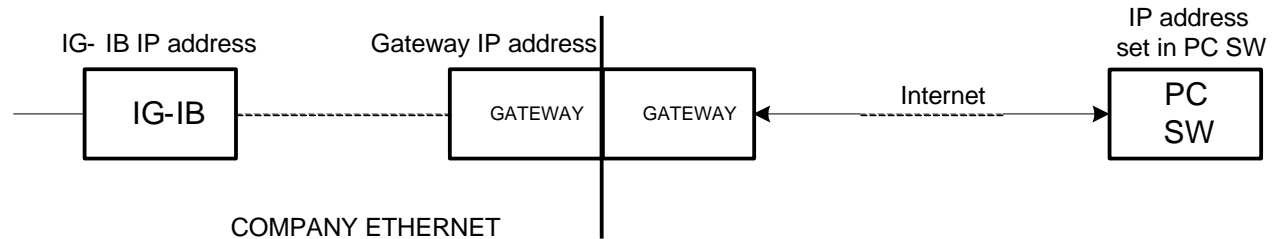
One controller - RS232 connection

In this case no dongle is necessary.
One unit could be also connected via CAN interface.
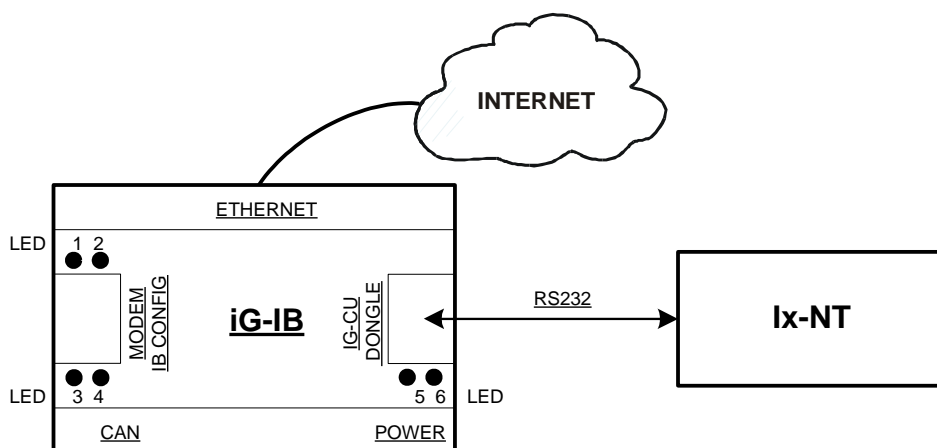
Two controllers – CAN / Ethernet connection

The dongle must be used. The type of IG-IB dongle limits number of accessible controllers (up to 32).
Dongles for up to 3, 7, 15 and 32 controllers are available. See also IG-IB Dongle
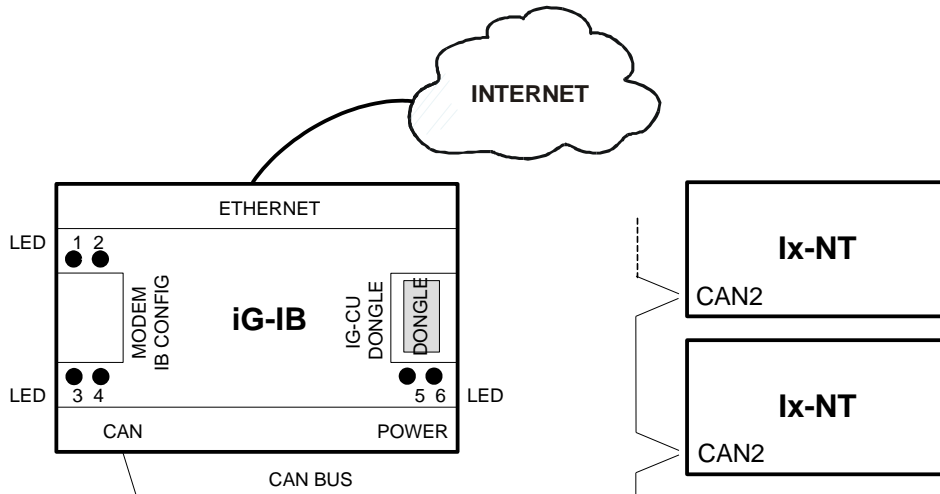
Max four PCs can be connected to one iG-IB at once
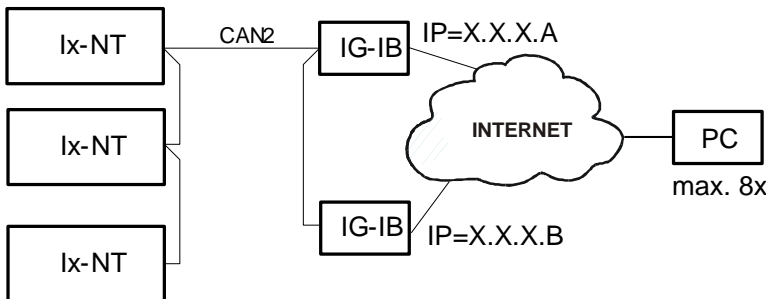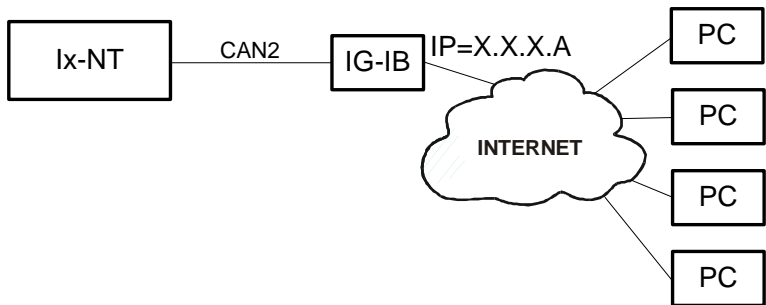
If more than 8 IGS-NT or other controllers are used with intercontroller CAN bus and monitored via IG-IB or I-LB units, the reaction on commands issued from InteliMonitor or other monitoring SW can be delayed up to several seconds. The same holds for values reading, i.e. refresh of measured power etc. in InteliMonitor or other PC SW.

Hint:
Contact local IT manager in any case before using iG-IB.

Indication and Diagnostic LED's
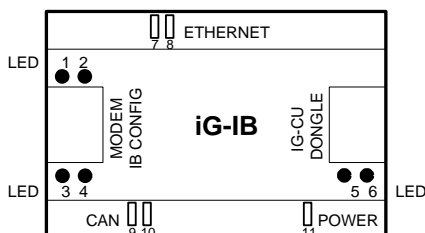
LED 1,2	Mode of iG-IB operation - see the table below
LED 3,4	Modem / Config line Rx, Tx activity
LED 5, 6	IG-CU data Rx, Tx activity
LED 7	Ethernet LINK (connection)
LED 8	Ethernet ACT (activity)
LED 9,10	CAN interface activity
LED 11	POWER supply indication

LED1	LED2	IG-IB V2.0
Light	Dark	After power switch on = iG-IB hardware fail. Unit has to be sent to repair.
Blinks together		Wrong configuration, iG-IB must be configured by IBConfig software tool 2.0
Lights both		Active IBConfig software. iG-IB does not communicate to ETHERNET or modem.
Blinks alternately		Invalid firmware or firmware downloading
Light	Dark	E-mail data reading from controller
Dark	Light	E-mail data sending to internet
Dark both		OK running state
Fast 0,1s blink	Dark	Modem initialization
Slow 0,3s blink	Dark	CAN bus rate detection

Hint:

Maximal length of UTP cable must be smaller than 100m to the nearest Switch/hub according to IEEE802.3 (100Base-T)

IG-IB Configuration

It is necessary to configure unit before its first use because new IG-IB from factory is not configured.

Internet Bridge can be connected to Internet
        via LAN – Ethernet connector or
        via dial up – MODEM connector.

Maximal length of UTP cable (between IG-IB and Switching hub) is 100m according to IEEE 802.3.

Corresponding firmware must be downloaded to IG-IB depends on required connection type.

IG-IB interface	Firmvare V2.5
LAN – Ethernet	IG-IB-ethn_2.5.bin
Dial up – Modem	IG-IB-dial_2.5.bin

For IG-IB V2.5 firmware configuration use IG-IB configuration tool (IBConfig.exe) at least V1.2 or higher. IBConfig of V1.2 can be used for IG-IB firmware 1.0 and 1.1 as well.
For IG-IB V2.1 firmware configuration use IBConfig at least V1.4 or higher.

Hint:

You cannot update firmware in IS-Display terminal by means of IG-IB version 2.0 and lower. Available support for IGS-NT is in IG-IB 2.1 and higher. In case you use 2.0 version, the message appears (Access not allowed (object 24431)) because IG-IB is not able to work with IS-Display.

IG – IB jumpers:
The hardware jumpers have following meaning:
P1 – test mode – should be disconnected!
P2 – internal use – should be disconnected!
P3 – reset – should be disconnected!

Connect
      iG-IB power supply,
      "MODEM/IB CONFIG" RS232 interface cable to PC and

Run

… \ ComAp \ TOOLS \ IBConfig \ IBConfig.exe   software.
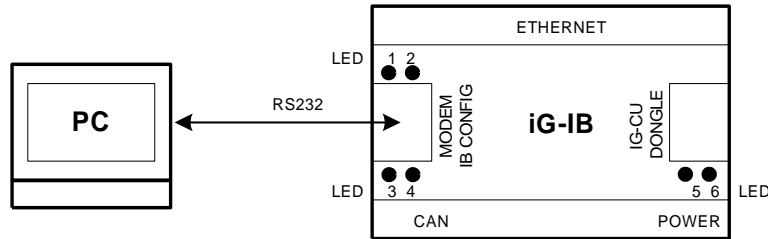
Set COM port:
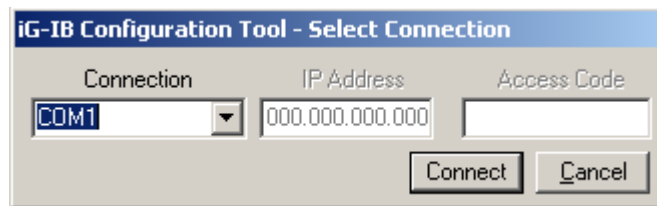
Remote access (TCP/IP connection) to IG-IB may be denied if incorrect Access Code is used. Access denied warning is displayed by IBConfig then:
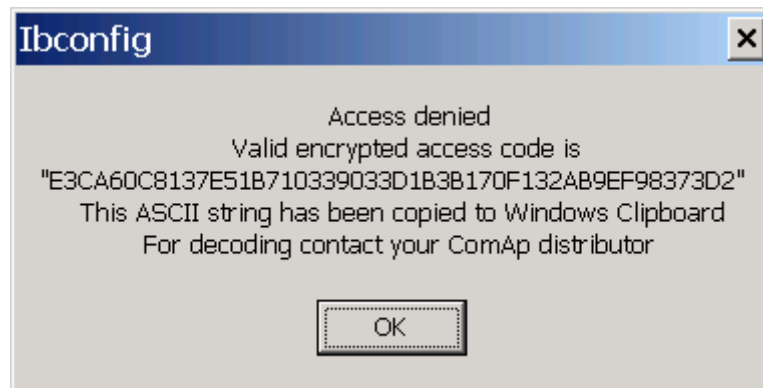
What you need to do in such case is to paste the string (it is saved automatically) into an e-mail and send it to your distributor to obtain a correct access code.

Ethernet LAN Configuration
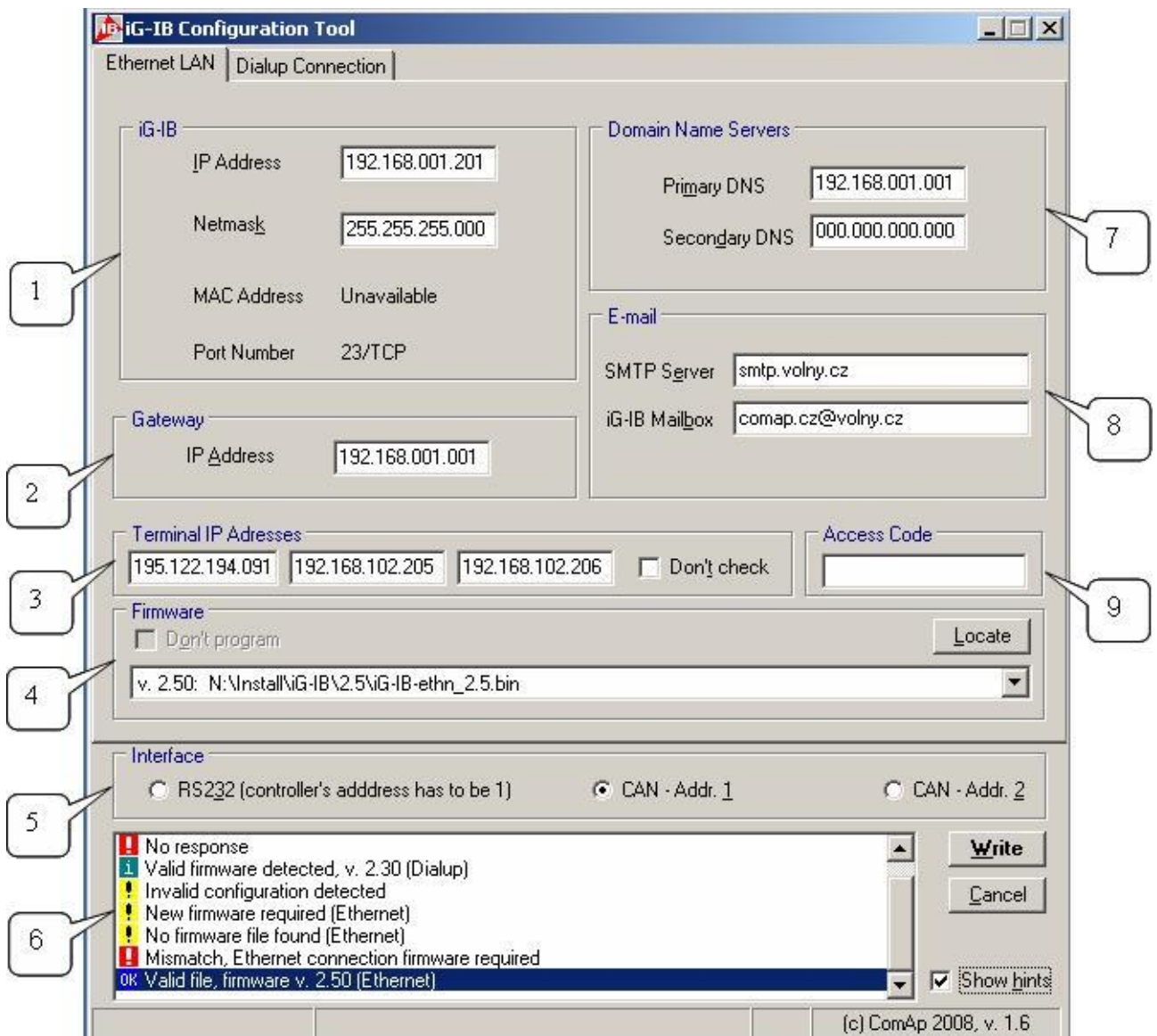
These settings are only as an example!

Please notice:
Setting CAN-Addr.1 was interchanged with setting CAN-Addr.2 starting with IBConfig-1.6. It
means that IG-IB's CAN address has to be set to CAN-Addr.2, if I-LB which is set to the address
ADR1 is connected to the same CAN bus as IG-IB. Use option CAN-Addr.1 if I-LB is set to ADR2.
It is necessary to set IG-IB's CAN address using IBConfig-1.5 in this way: IG-IB's CAN address has to
be set to CAN-Addr.1, if I-LB which is set to the address ADR1 is connected to the same CAN bus as
IG-IB. Use option CAN-Addr.2 if I-LB is set to ADR2.

Set following items in IG-IB configuration window.

1	**IG-IB**	IP Address	Ask your IT manager
		Netmask	Ask your IT manager
		MAC Address	Ask your IT manager
		Port Number	Ask your IT manager
2	**Gateway**	IP Address	Ask your IT manager
3	**Terminal IP Addresses**		Connection will be restricted to these terminal IP addresses, i.e. IG-IB won't connect to any other address.
		Don't check	Tick "**Don't check**" if you want to allow connection to all terminal IP addresses.
4	**Firmware**		Firmware file name (*.bin) is displayed in this window when old iG-

			IB firmware version is detected. It is possible to select any iG-IB "*.bin* " firmware file using Locate button. iG-IB firmware is located in WinEdit directory *\Program files\Comap\WinEdit\Tools\IBConfig\Firmware\ *.bin*. If you check "*Don't program*" checkbox, the firmware is not downloaded (only settings).
5	**Interface**	RS232 CAN1 CAN2	Connection of IG-IB to controller via RS232 Connection of IG-IB to controller via CAN Two IG-IB's on CAN bus
6	**Message window**		Messages window contains messages regarding detected (actual) firmware version and configuration validity. Here you can also get information on configuration process. If you get the "*No response*" message, check once more COM setting and communication cable. If everything is OK and you still get the "*No response*" message the unit must be reprogrammed in the factory.
7	**Domain Name Servers**	Primary DNS Secondary DNS	Get from your IT manager
8	**E-mail**	SMTP Server IG-IB Mailbox	Necessary only when Active e-mails are enabled in Controller. It is used as a sender address when iG-IB sends active e-mail. See Setpoints *Act.cals/SMS*: *AcallCHxType* = E-MAIL or EML-SMS.
9	**Access Code**		Code for unblocking the remote communication with the controller. Use InteliMonitor/DriveMonitor to enter or change access code.

IG-IB connection to internet (Ethernet)

Hint:

Your local LAN connection to the Internet is probably configured to enable access the servers located on the Internet, but to disable access in the reverse direction.

If iG-IB is to be visible from the Internet, then your IT manager should create a communication channel on the Internet access server.

The iG-IB uses the TCP-communication and listens at the port 23 (known as Telnet port).

Hint:

Some providers have strict requirements for e-mail iG-IB Mailbox address = existing mailbox.

Dialup Connection Configuration

Use firmware V2.0 and higher for dialup connection.
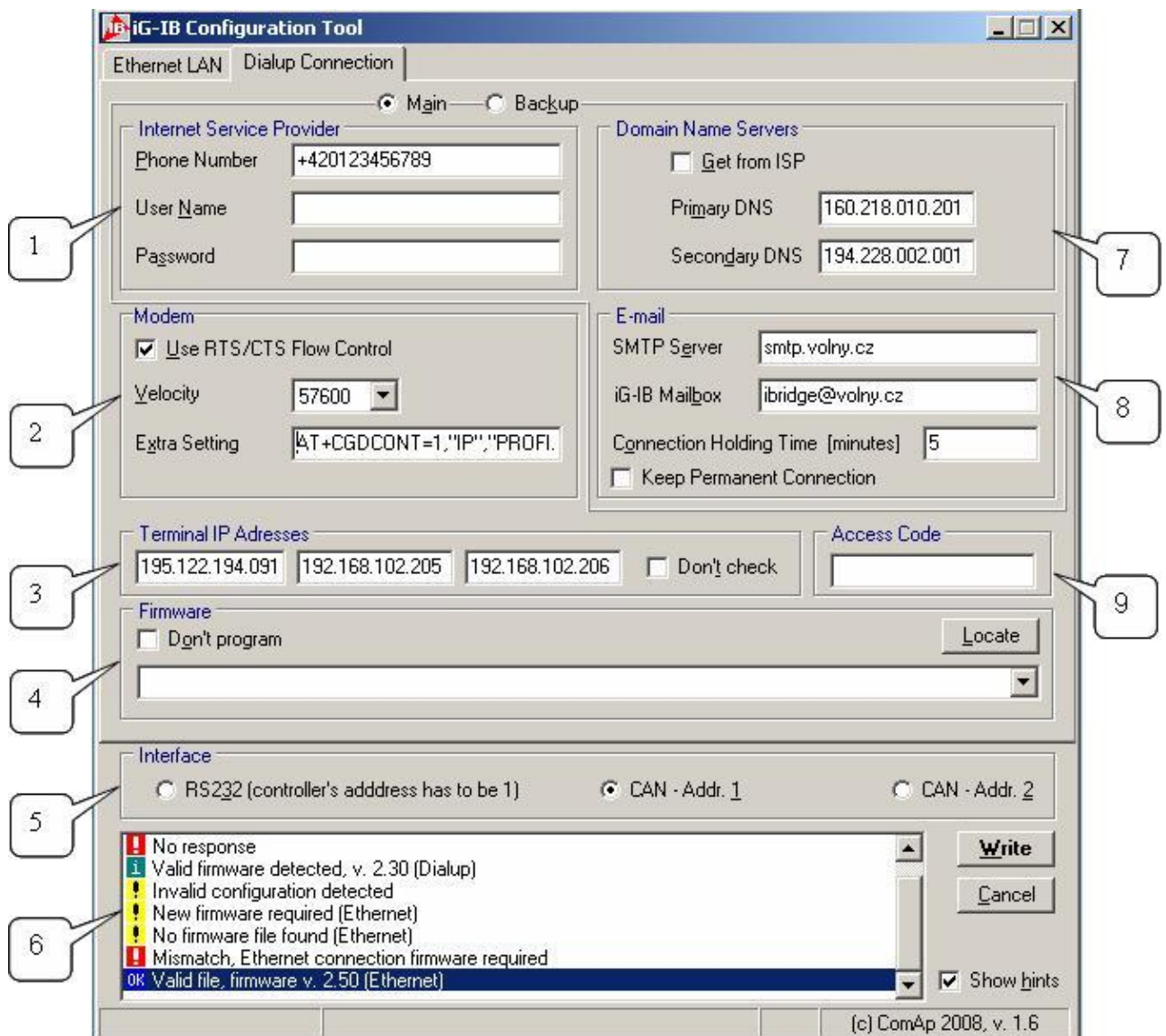
Connection to ISP

There are two Internet Service Provider sets ⊙ M<u>a</u>in and ⊙ Bac<u>k</u>up .
Phone number is dialed using ATD command. The main ISP is dialed as first. The backup ISP is dialed when it is not possible to open the main ISP connection.
IP addresses for DNS servers can be obtained from ISP ("Get from ISP") or explicitly set in configuration.

Modem initialization

Modem must accept following ASCII characters: Escape = ASCII 43 (=character +), ASCI 13 (= CR) and ASCII 10 (= LF). Then Following commands are sent to Modem.
1. ATZ
2. ATE0V0Q0S0=0
3. ATV0Q0X0S0=1

Active e-mail

Active e-mail can be sent only when operating modem is detected. IG-IB makes five open connection attempts on active e-mail request. There are three attempts to sent e-mail when connection is opened. Connection is opened for "Connection holding time" after e-mail is successfully sent.

Note for iG-IB firmware version 1.0 or 1.1 users: active e-mail sending may fail if selected SMTP server returns a multiline responses. Use firmware version 2.0 to solve this problem.

Configuration items

1	**Internet Service Provider**	Phone Number User Name Password	Data from local Internet provider
2	**Modem**	Use RTS/CTS Flow Control	Check if the modem requires RTS/CTS signals.
		Velocity	Only when velocity auto detect is not active.
		Extra Setting	Those "special" commands for modem configuration are sent to modem during init procedure.
3	**Terminal IP Addresses**		Connection will be restricted to these terminal IP addresses, i.e. IG-IB won't connect to any other address.
		Don't check	Tick "***Don't check***" if you want to allow connection to all terminal IP addresses.
4	**Firmware**		Firmware file name (*.bin) is displayed in this window when old iG-IB firmware version is detected
5	**Interface**	RS232	Connection to controller
		CAN1	Connection to controller
		CAN2	Two IG-IB's on CAN bus
6	**Messages window**		Messages window contains messages regarding detected (actual) firmware version and configuration validity. Here you can also get information on configuration process.
7	**Domain Name Servers**	Get from ISP Primary DNS Secondary DNS	Get from your IT manager
8	**E-mail**	SMTP Server IG-IB mail box	E-mail setting is necessary only when Active e-mails are enabled in Controller. It is used as a sender address when iG-IB sends active e-mail.
		Connection Holding Time	After e-mail is successfully sent, waiting for operator response.
		Keep Permanent Connection	If checked connection to ISP is never terminated. It is established immediately after IG-IB is initialized. If the communication is interrupted, it is re-established. It is necessary that the IP address of IG-IB is static so that the PC software (e.g. WinEdit) "knows" to which address to re-connect. If this option is not selected, the connection to ISP is established on request from terminal only. IP address obtained from ISP is then sent to the terminal via email (IP address can be dynamic in this case).
9	**Access Code**		Code for unblocking the remote communication with the controller. Use InteliMonitor/DriveMonitor to enter or change access code.

Hint:

Some providers have strict requirements for e-mail iG-IB Mailbox address = existing mailbox.

IG-IB Interface

There are following connectors on iG-IB unit:

Modem / IB Config	RS232 interface for iG-IB configuration or Modem connection (not supported in SW version1.0)
Dongle	RS232 interface to Controller or for Dongle for multiple controllers communication (controller data are transferred via CAN bus)
CAN bus	Interface to one or group of controllers (IG/IS-NT, ID)
Ethernet to LAN	Interface to Ethernet

IG-IB Dongle

IG-IB Dongle limits number of accessible controllers.
Following addresses must be used for given dongle type (e.g. dongle IG-IB3 enables connection to controllers with addresses 1,2 and 3 only).

Dongle type	Number of accessible controllers
No dongle	1
Dongle IG-IB3	2 to 3
Dongle IG-IB7	2 to 7
Dongle IG-IB15	2 to 15
Dongle IG-IB32	2 to 32
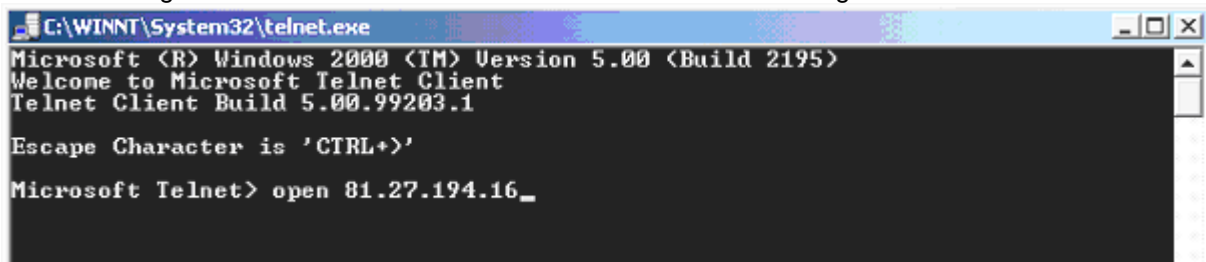
Hint:
From IG-IB-2.1 the dongle sets the limit of number of connected controllers. If the controller is connected via RS232, the address 1 is supposed. Currently it is possible to order only dongle IG-IB32 as replace for all others dongles that got obsolete.
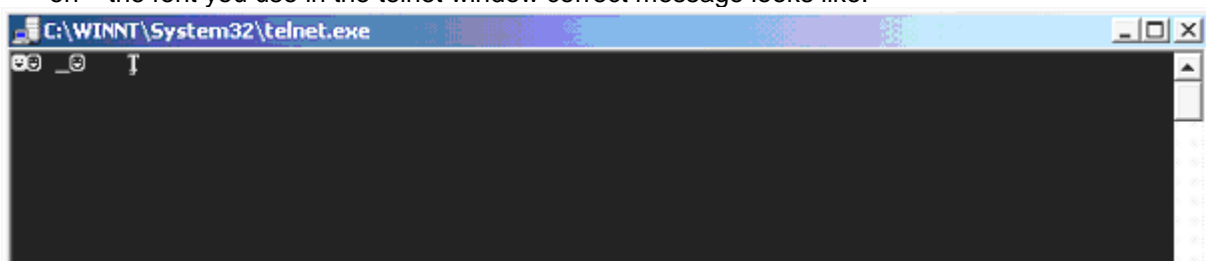
Internet Connection Diagnostics

Following method is Comap PC SW independent way how to check connection from PC via Internet to some controller.
The basic diagnostic of iG-IB to internet connection could be done using telnet software:

1) Start telnet software
2) In telnet window write command „open xxx.xxx.xxx.xxx"
3) If the connection is OK, you should get a nontext (binary - firmware version) answer. Depending on the font you use in the telnet window correct message looks like:

Hint:
Telnet software is included in standard Windows installation. To run telnet use Windows Start – Run button and write "telnet", OK.

How to Access IG-IB behind Firewall

The solution principle is shown in attached picture. All addresses in this text and in the picture are fictive and will be different on real installation, port numbers are real. If the network software is configured as shown in picture, users from Internet will be able to connect from Comap PC SW to address 195.122.194.89 and communicate with IG-IB behind firewall. So in fact, we enter to PC SW different address than is configured in IG-IB, as is correctly noted in the manual.
Needed changes are these:
1. DHCP server in private network (if used): exclude address 192.168.1.250 from the address poll which are available to lease from this server, so that this address couldn't be assigned to any device in the network. This will make this address available for use by IG-IB.

2. Firewall: Configure transparent proxy channel from external interface 195.122.194.89, port 23 to protected network, internal address 192.168.1.250, port 23. This transparent proxy will do all network address translation needed when communicating from public network with internal private network. Port 23 on interface 195.122.194.89 should be usually free for this use, as normally is this port used for telnet service and telnet is considered dangerous to use on firewalls.
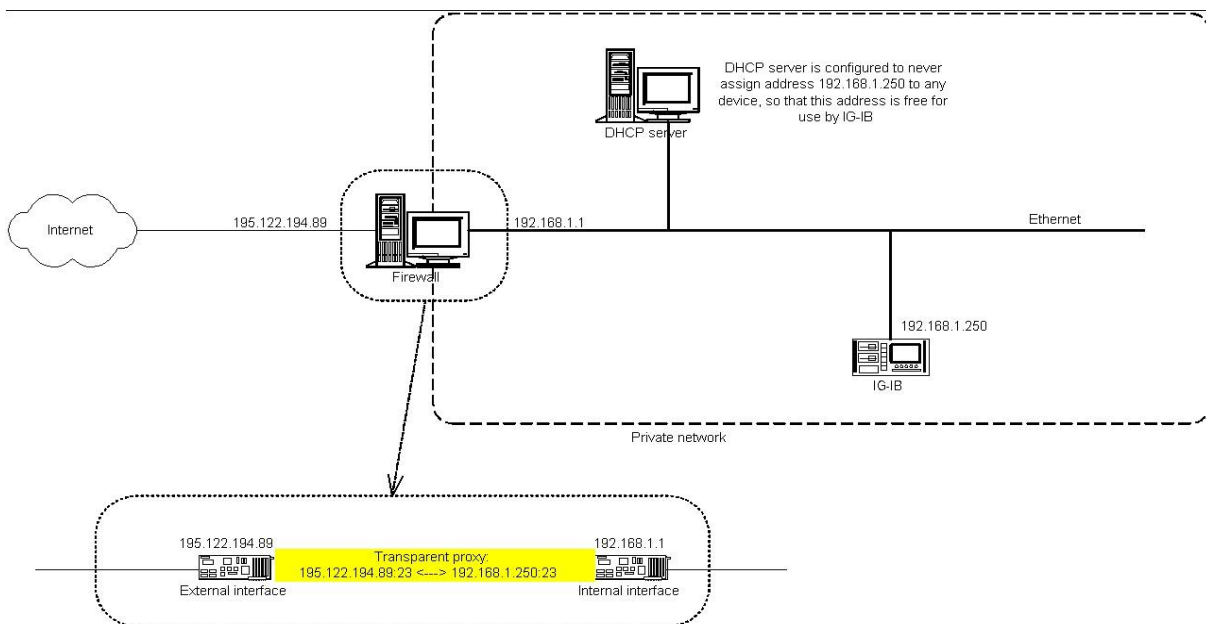
I-CR Module for CAN Bus Extension

If the distance between units is too high to fit into the 200 m limit (or 900 m for 8 controllers), CAN repeater module (I-CR) can be used to extend it.
Typical case – in line extension:
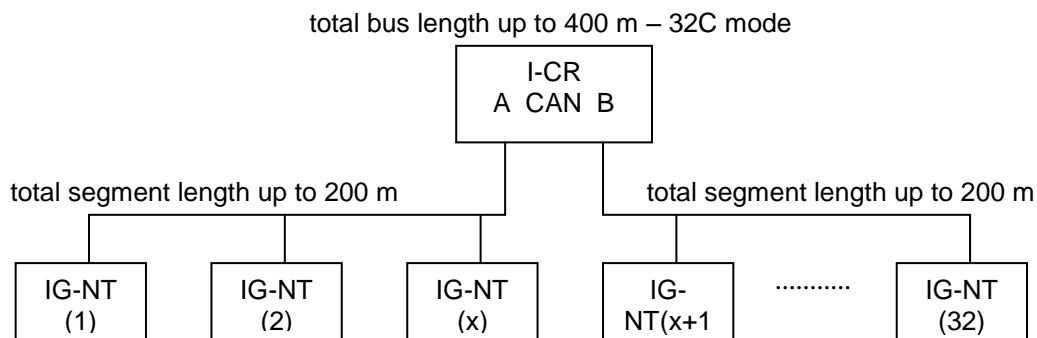
Connection of I-LB, combination of different CAN bus speeds:
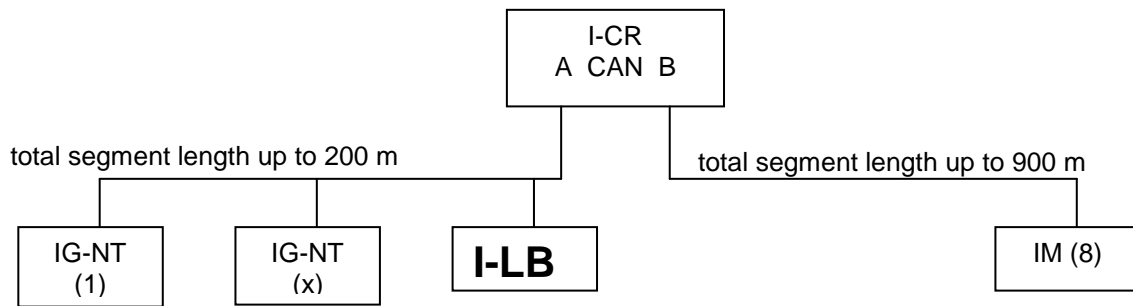
This connection allows PC communication to all controllers in the system (e.g. via InteliMonitor), including a distant InteliMains unit.

I-CR module functions:

- Intercontroller CAN bus extension (one or more I-CR modules can be used).
- Intercontroller CAN bus bus-tie bridging – makes groups of controllers in segments A and B "invisible" one for another depending on bus-tie breaker state, keeping the PC communication (I-LB, IG-IB) in function for all controllers.
- Peripheral CAN bus extension

I-CR configuration jumpers:

P2 – Forces 250 kbps mode (32C) on CAN A, otherwise speed autodetection is used.
P3 – Forces 250 kbps mode (32C) on CAN B, otherwise speed autodetection is used.
P4 – Activates Filter mode (bus-tie bridging).
P5 – Forces alternate controller address 3 for bus-tie status reading (default controller address is 4).
P10 – If "H" network configuration used (two I-CR units), it must be switched to RS-422 mode.

I-CR indication and diagnostic LEDs:
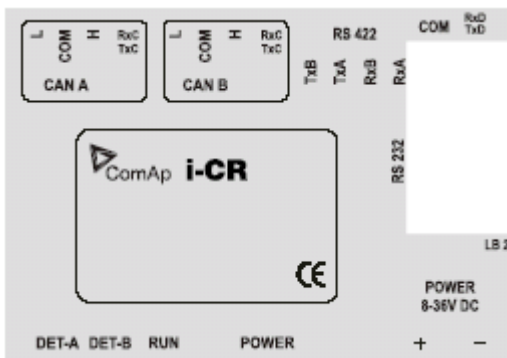
For more detailed information about I-CR, see the Application sheet "**Extending the CAN bus**" or IGS-NT-x.y-Installation guide.pdf.

Hint:
CAN bus has to be terminated at both ends.
In the case of surge hazard (connection out of building in case of storm etc.) see the "Recommended CAN/RS485 connection" chapter of the IGS-NT-2.4-Installation guide.pdf.

I-CR-R Module for CAN Bus Redundancy

This module is intended to provide CAN bus redundancy in applications where IG/IS-NT controllers are placed in several switchboards that need to be interconnected by the CAN bus communication line and where there is essential to keep the line working. As a side effect, the module also provides the CAN bus line extension.

As the CAN bus provides data exchange needed for Load Sharing and VAr Sharing and also for Power Management features, it's redundancy can be very important in complex systems with more engines, more mains incomers.

From July 2014 is possible to order I-CR-R module(order code I-CR-R) with original stickers or it is posible to use I-CB/CAT GAS module and change the sw.(I-CR-R module is based on I-CB/CAT GAS HW.)

(For the replacement of the FW, you will need the FlashProg utility which can be downloaded in Peripheral Modules Upgrade Package here: http://www.comap.cz/support/download-center/type/software/. Chapter related to I-CB reprogramming is to be used.)

Hint:

I-CR-R may be used as a redundancy module for a maximum of 20 controllers (counted all controllers on the CAN2 bus).

For usage I-CR-R in an installation of more as 20 controllers please contact our technical support for another redundancy solution.

Typical case – several controllers, each one in separate switchboard:
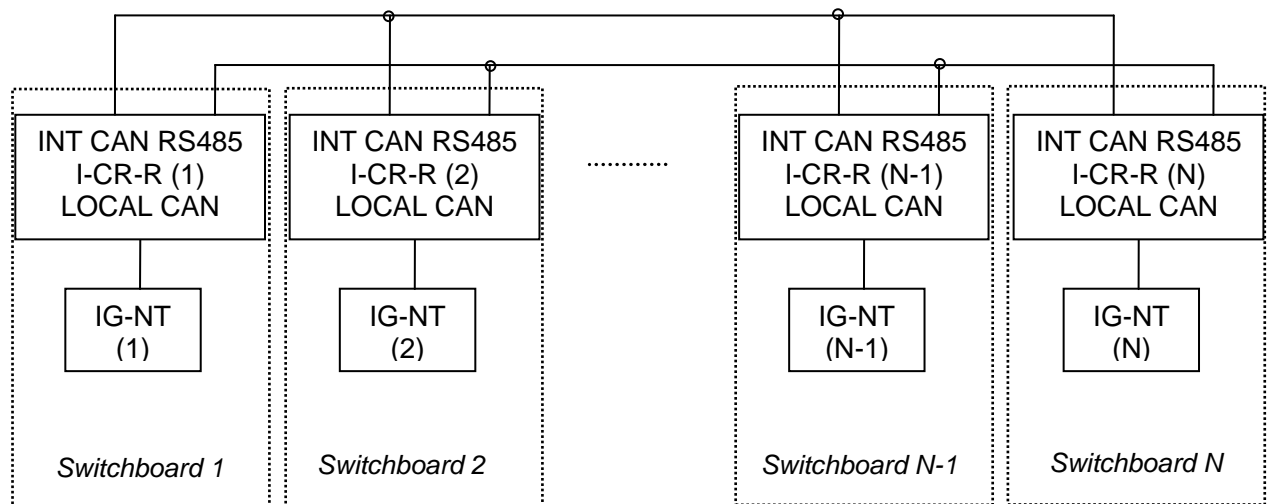
More controllers within common switchboard:
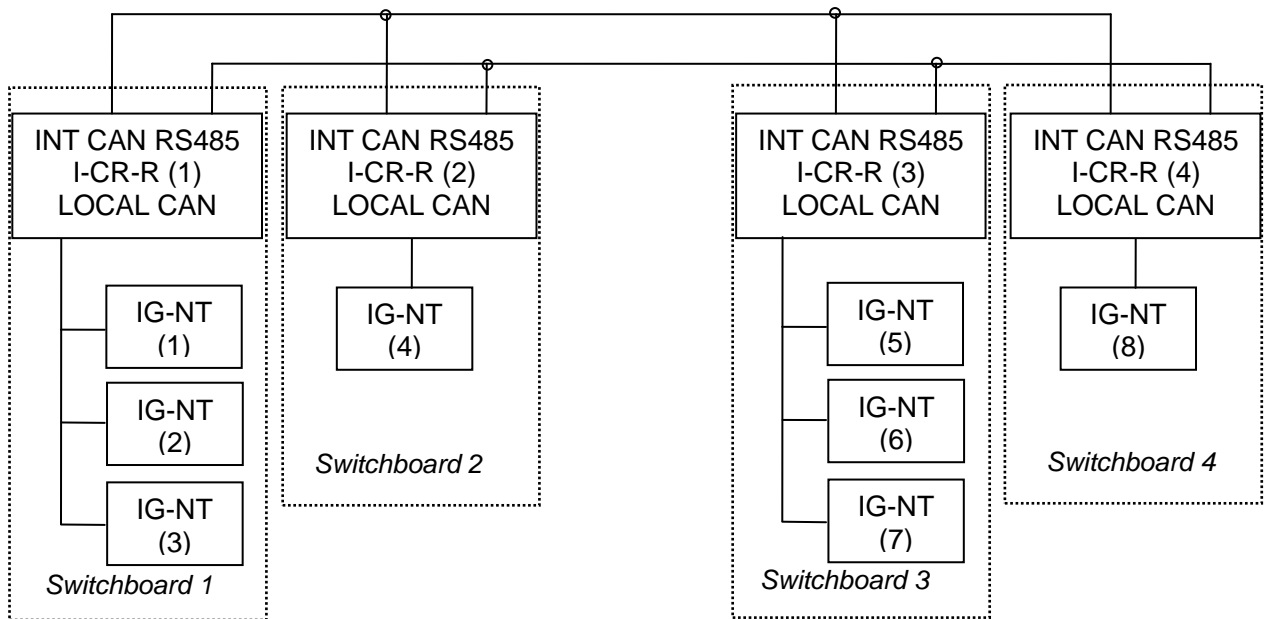
Connection of I-LB or other bridging modules:
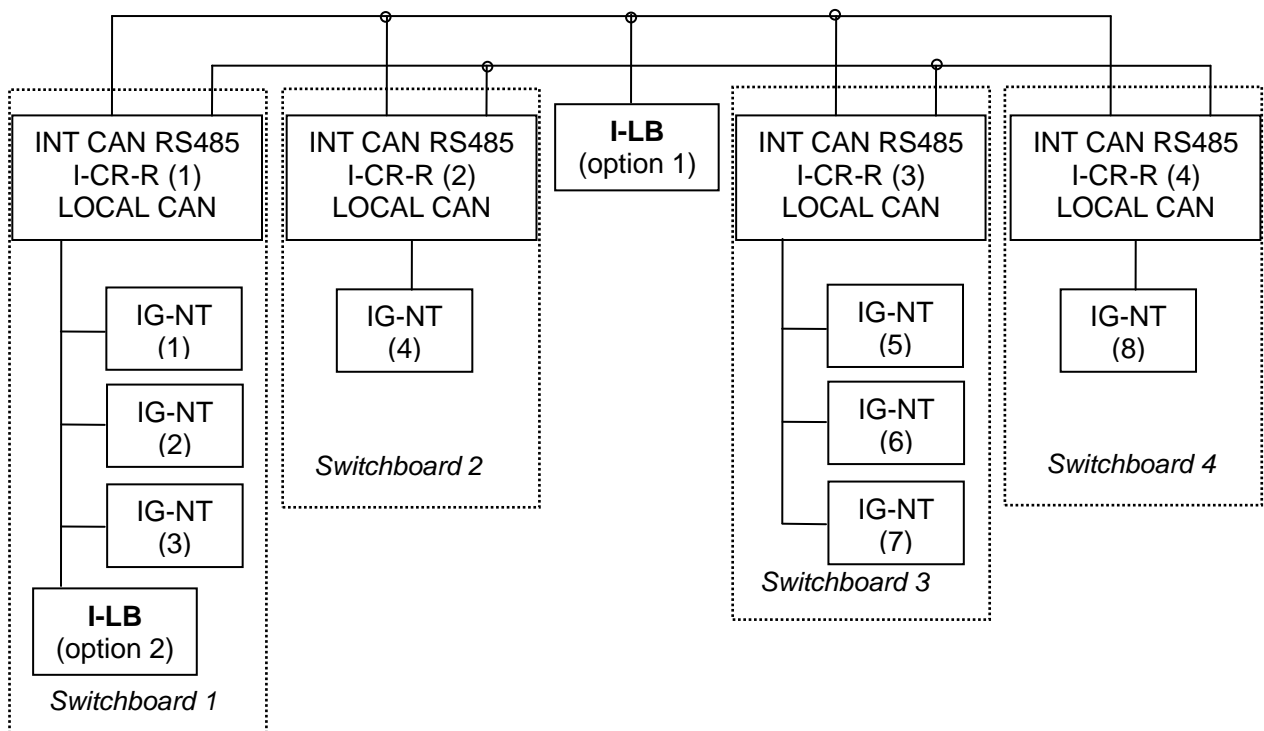
Note: If I-LB (or other bridging module) is to monitor all the site, it is recommended to place it at the position 1. If there is preferably monitored one group (within one switchboard) and the other controllers not at all or only seldom, option 2 is more suitable. Remote connection to let's say controller 7 is possible in this case but data transfer will be quite slow.

I-CR-R module functions:

- Intercontroller CAN bus redundancy – basic description of terminology used:
    - Local CAN bus – a bus going from the module to the local controller(s) = within one switchboard; name on the sticker CAN1 CONTROLLER; in standard installation (with no redundancy) this would be the intercontroller bus (CAN2)
    - Primary intercontroller CAN bus – a bus interconnecting all I-CR-R modules and providing 1 to 1 replacement of standard intercontroller CAN bus (CAN2); name on the sticker CAN EMS
    - Backup intercontroller RS485 bus – secondary bus interconnecting all I-CR-R modules; transmits only intercontroller communication (Load Sharing, VAr Sharing, Power Management), not the remote communication (I-LB, IG-IB connection to a PC monitoring tool); controller with address 1 must be presented in the system to make backup bus working
- The module preferably uses the Primary CAN bus line for data transfer. However, if the connection from any of the controllers connected to other I-CR-R modules is broken the module automatically re-routes it to the Backup RS485 line and continues in operation. From controllers' point of view, no data transfer interruption is observed.
- It is possible to indicate the problem with Primary or Backup buses using "fake" SHBOUT6 message which is normally used for signal sharing among the controllers. See jumper description further in the text.
- Intercontroller CAN bus extension – each I-CR-R module provides also CAN bus extension in the same way as I-CR module, i.e. creates segments of the bus where the length of the line is limited within the segment only, not within the whole system.

Note 1: The redundancy system only makes sense if the cables of Primary and Backup buses are placed physically into different cable routes! Placing them into the same cable route increases the risk of damage of both cables at once.

Note 2: For proper connection of RS485 line, connect the terminals TxA and RxA together and terminals TxB and RxB together. This should be done on each I-CR-R module and with short wire (see drawing).

RS485 line going to other I-CR-R modules
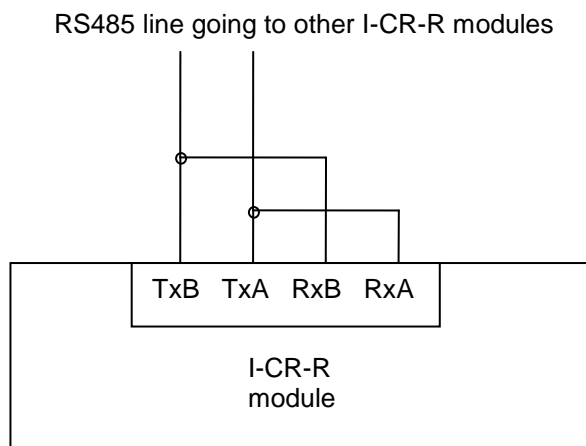
I-CR-R configuration jumpers:

P3 – Forces 8C (50 kbps) mode on Primary intercontroller bus (name at the original sticker CAN EMS); if not active, 32C (250 kbps) mode is automatically used.

Note: All I-CR-R modules within the system must be switched to the same mode, otherwise the primary intercontroller CAN bus won't work.

P4 – Enables transmission of SHBOUT6 message to local CAN bus; the message is intended to transmit indication and error flags from the module to the controllers to make the status of the module

visible to the customers. By sending this message, I-CR-R is "cheating" the controllers in it's local CAN bus because it is pretending to be one of the other controllers (from intercontroller bus) sending this message. Do not use the real source for SHBOUT6 message if this feature is enabled.

Contents of the SHBOUT6 message:

Position (bit 8 = highest)	Description
bit 8	Always 1 (reserved)
bit 7	Always 1 (reserved)
bit 6	Always 0 (reserved)
bit 5	Always 0 (reserved)
bit 4	Logical 1: Modbus Master (controller with adress 1 on the line) is detected
bit 3	RS485 overload occurred (= more data in the queue than could be transmitted via this line)
bit 2	Logical 1: indicates this (local) controller is Modbus Master
bit 1	Difference of "visible" controllers between Primary and Backup bus occurred -> Probably failure in one of the intercontroller lines

Note 1: Typically, configure a Warning-type protection on the lowest bit signal of this message. The signal becomes active if part of controllers normally "visible" through the Primary or Backup bus is not visible anymore; this means the cable was cut or shorted or otherwise damaged and doesn't connect anymore some part or all the controllers.

Note 2: Because bit 1 activates with the difference between Primary and Backup buses it is able to indicate failures of both Primary and Backup buses, so even if Primary bus works fine, it is able to show the problem with Backup bus to allow the technician to repair it before it actually becomes a problem. Otherwise the problem with the Backup bus would stay hidden until Primary bus would have failed and then the intercontroller communication would stop working completely.

I-CR-R indication and diagnostic LEDs:

LED	State	Function
PWR	Lights	If all other LEDs except of the PWR LED are dark the FW is located in a wrong type of module; please make sure that I-CB/CAT GAS HW is present
	Dark	If all LEDs are dark there is no power supply to the module
RUN	Lights	Firmware is OK and running
	Slow flash	Firmware corrupted (periodic Watchdog reset)
	Fast flash	RS485 was interrupted or no master found on RS485 backup bus; (controller with address 1 must be presented in the system to make backup bus working)
CONTR	Lights	Local CAN bus is running OK (between controller and I-CR-R)
	Flashes	No controller detected on local CAN bus; on local bus, speed 32C is always expected (short connection only – within the switchboard)
EMS	Lights	communication on CAN bus between I-CR-Rs is running
	Flashes	CAN bus between I-CR-Rs was interrupted Automatic speed detection 32C / 8C; enters this mode if no controller/transmission detected on Primary intercontroller bus (for 2 s)
CAN CONTR (TxC, RxC)	Flashes	Local CAN interface activity
CAN EMS (TxC, RxC)	Flashes	Primary intercontroller CAN interface activity
COM (TxD, RxD)	Flashes	Backup intercontroller RS485 interface activity

Appendix

Communication cables

Recommended communication cables for ComAp controllers

Interface	Cable	Connector	max. Length	Max. Comm. Rate
RS232	Serial cross-wired cable	DB 9	10 m	57.6kBd
	standard Null-modem cable	DB 9		
RS485	Shield twisted pair [1]	NONE	1000 m	57.6kBd
Ethernet	STP or UTP cable	RJ45	100 m	10/100 Mbps
USB	Standard USB A-B cable	USB A-USB B	5 m	115200 Bd
CAN	Shield twisted pair [2]	NONE	200 m / 900 m	250 kBd

1) RS 485 cable
B) For longer distances: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)
Recommended data cables: BELDEN (http://www.belden.com)
A) For shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors)

2) CAN bus cable
Galvanically separated
Maximal CAN bus length 200m Speed 250kBd
Nominal impedance 120Ω
Cable type twisted pair (shielded)
Following dynamic cable parameters are important especially for maximal 200 meters CAN bus length and 32 iS-COM units connected:
Nominal Velocity of Propagation min. 75% (max. 4,4 ns/m)
Recommended data cables: BELDEN (http://www.belden.com)
A) For shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors)
B) For longer distances: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

In case of surge hazard: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)

RS232 cable

It is recommended to use standard Null-modem cable for local connection between controller and PC, although the three wires (TxD, RxD, GND) RS 232 connection is enough for direct controller to PC communication:
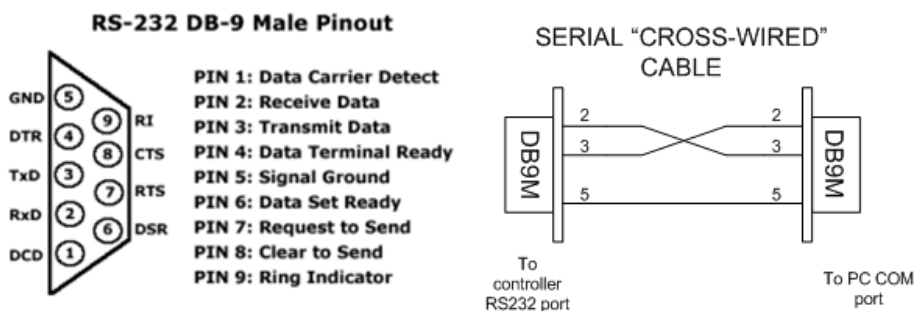
Cables for direct and modem connections

PC to RS232 on controller / I-LB
DB9 Female to DB9 Female

2	3
3	2
5	5

Modem to RS232 on controller / I-LB
Comms settings: MODEM (HW) or I-LB jumper HW control
DB9 Male to DB9 Female

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Comms settings: MODEM (SW) or I-LB jumper SW control
DB9 Male to DB9 Female

2	2
3	3
5	5

USB cable

Use standard USB A-B cable (distance up to 5 meters).

Connector A — USB-A
Connector B — USB-B

CAUTION!
Use shielded USB cable only! (ComAp order code: USB-LINK CABLE 1.8m)

! IMPORTANT !

To use USB connection it is necessary to install drivers on your PC.
The drivers can be downloaded from the website http://www.ftdichip.com/Drivers/VCP.htm.
Download the driver for your operating system and follow the enclosed instructions.

After successful installation of the driver and connection of the controller or I-LB+ to the PC the new Virtual Communications Port appears in ComAp PC tools and it is possible to open connection via USB.

Ethernet cable

It is recommended to use standard UTP or STP cable with connectors RJ 45. Maximal length of cable is 100 m. For direct connection between Controller and PC is necessary to use cross-wired cable (only in case that your PC does not have automatic recognizing of direct and cross-wired cable).

CROSS-WIRED UTP 10/100Mbit CABLE
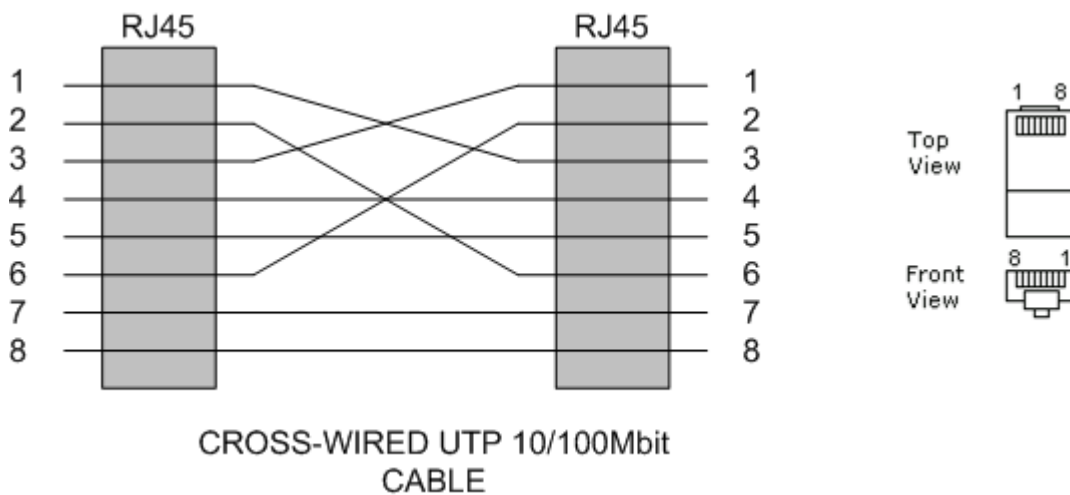
CAN bus connection

The bus has to be terminated by 120 Ohm resistors at both ends.
External units can be connected on the CAN bus line in any order, but keeping line arrangement (no tails, no star) is necessary.
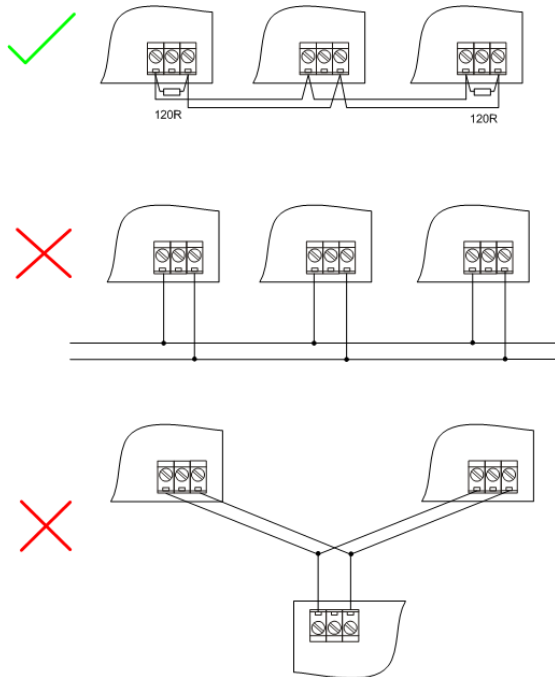
Standard maximum bus length is 200m for 32C CAN BUS MODE and 900m for 8C CAN BUS MODE (setpoint in comms setings group)
Shielded cable has to be used, shielding has to be connected to PE on one side (controller side).
Recommended data cables: BELDEN (http://www.belden.com)
A) For shorter distances: 3105A Paired - EIA Industrial RS-485 PLTC/CM (1x2 conductors)
B) For longer distances: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)
C) In case of surge hazard: 3106A Paired - EIA Industrial RS-485 PLTC/CM (1x2+1 conductors)
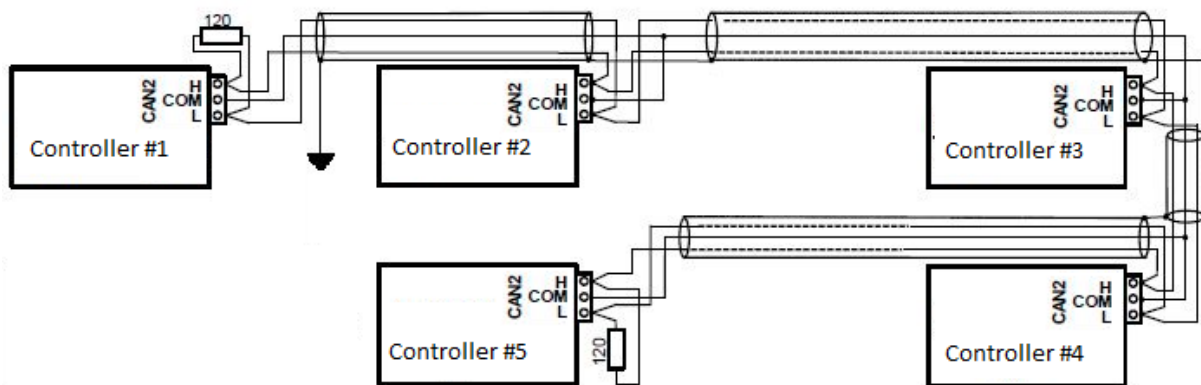
CAN bus extension options

CAN/fiber optic converter
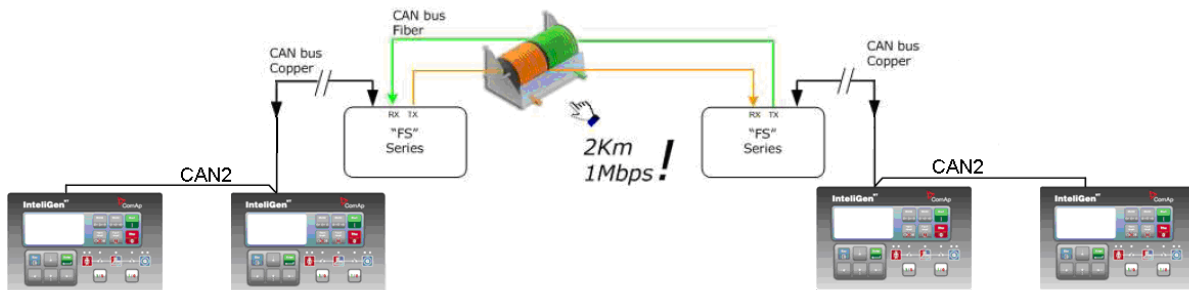
- Extends CAN bus length by 2000m.

Recommended converters

- **ADF Web** HD67181FS or HD67181FSX (www.ADFweb.com)
  http://www.adfweb.com/home/products/optics_fibres_can_bus_repeaters.asp
  It is simple converter without redundant power supply. It has no alarm contact.
  Wide Power Supply voltage: 8-19VAC or 8-35VDC. DIN mounting. Multimode version only.
  Number of converters in cascade is limited. Tested 4 optical links (8 converters) in cascade
  with no problem with communication. However "star" topology is better to use.

HD671xxF   HD671xxFSX

Recommended settings

Use converter Baud Rate Setting to 250k if setpoint *Comms setting: CAN bus mode* is set to 32C in
controllers:

Use converter Baud Rate Setting to 50k if setpoint *Comms setting: CAN bus mode* is set to 8C in
controllers:

CAUTION!
This device can extend total CAN bus length by 2000m (HD67181FSX only) using optical link, but total
length of metalic CAN bus must not exceed these values:

200 m if setpoint *Comms setting: CAN bus mode is set to 32C in controllers*
900 m if setpoint *Comms setting: CAN bus mode is set to 8C in controllers*

- **eks**
  http://www.eks-engel.de/en/products/can-fiber-optic-konverter/
  - DL-CAN/1x13 – Point to point
  - DL-CAN/2x13 – Bus topology without redundancy
  - DL-CANR/2x13 – Redundant link topology

  Industrial converters with dual (redundant) power supply 12-30VDC. Alarm contacts available. DIN mounting. Available multimode and single mode version.

Point to Point Topology

eks DL-CAN/1x13   eks DL-CAN/1x13

= 2 fiber cores, Multimode or Singlemode (up to 100 km)

= CAN bus

Bus Topology

eks DL-CAN/1x13   eks DL-CAN/2x13   eks DL-CAN/2x13

eks DL-CAN/1x13   eks DL-CAN/2x13   eks DL-CAN/2x13

= 2 fiber cores, Multimode or Singlemode (up to 100 km), No limitation regarding cascading
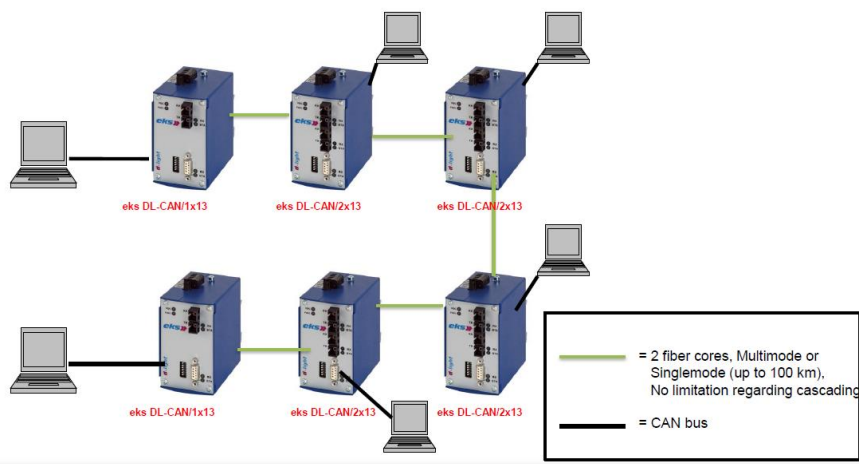
= CAN bus

Redundant Ring Topology
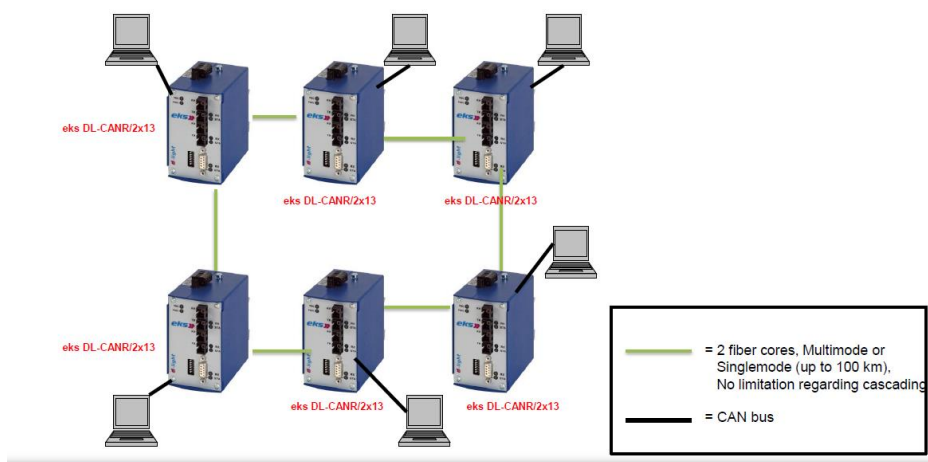
CAUTION!
This device can extend total CAN bus length by 100km between 2 converters (single mode version only) using optical link, but total length of metalic CAN bus must not exceed these values:
200 m if setpoint *Comms setting: CAN bus mode is set to 32C in controllers*
900 m if setpoint *Comms setting: CAN bus mode is set to 8C in controllers*

CAN-Ethernet gateway
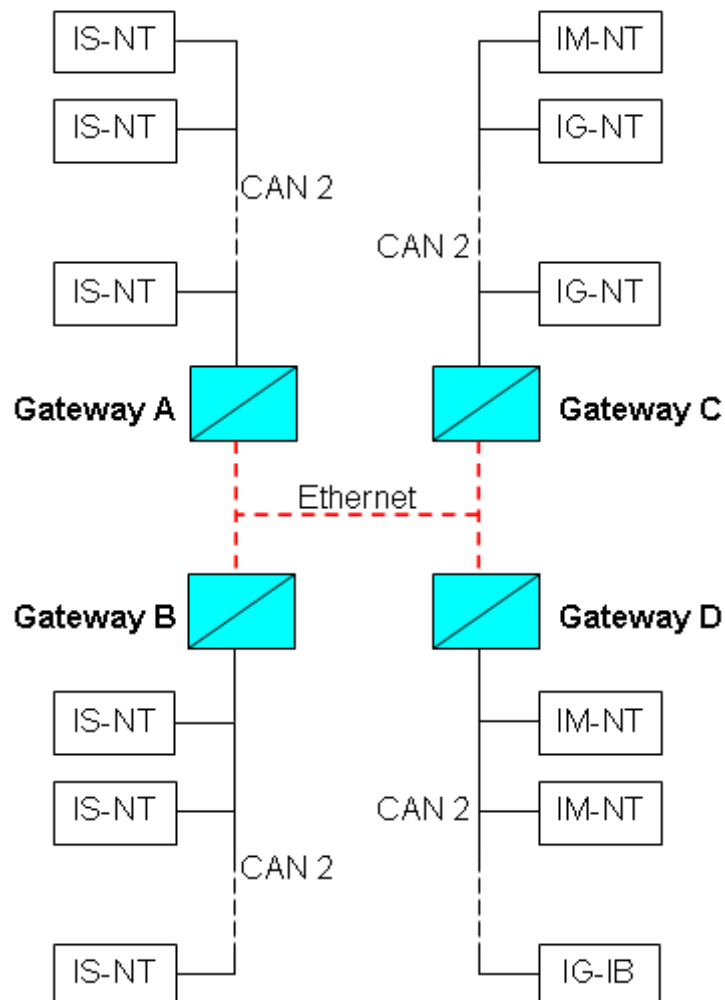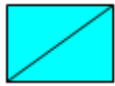
CAN-Ethernet gateway

CAN-Ethernet gateway allows you to merge up to four CAN bus branches into one global CAN bus using Ethernet connection. For detailed information about this option see:
http://www.comap.cz/support/downloads/fail/AS10%20-%20Ethernet%20based%20CAN%20extension%20r1.pdf

Hint:
For CAN bus extension is possible to use I-CR module. It allows extension of CAN to more segments with next 200m adition length. for more information read chapter I-CR Module for CAN bus extension.

RS485 connection

External units can be connected on the RS485 line in any order, but keeping line arrangement (no tails, no star) is necessary.
Standard maximum line length is 1000m.
Shielded cable has to be used, shielding has to be connected to PE on one side (controller side).

RS485 and CAN bus line has to be terminated by 120 ohm resistors on the both ends. Always check the number and placement of terminating resistors in the CAN bus line, only correct wiring ensures reliable operation! Resistors must be placed at either end of the line (see picture), and correct number of resistors must be used! Correct number can be checked using ohmmeter - when power supply for ALL devices on the CAN bus line is switched off, the resistance measured between A and B wire should be 60 Ohms. For longer distances is recommended to connect CAN COM terminals between all controllers and cable shielding to the ground in one point. External units can be connected on the CAN bus line in any order, but line arrangement (no tails no star) is necessary.
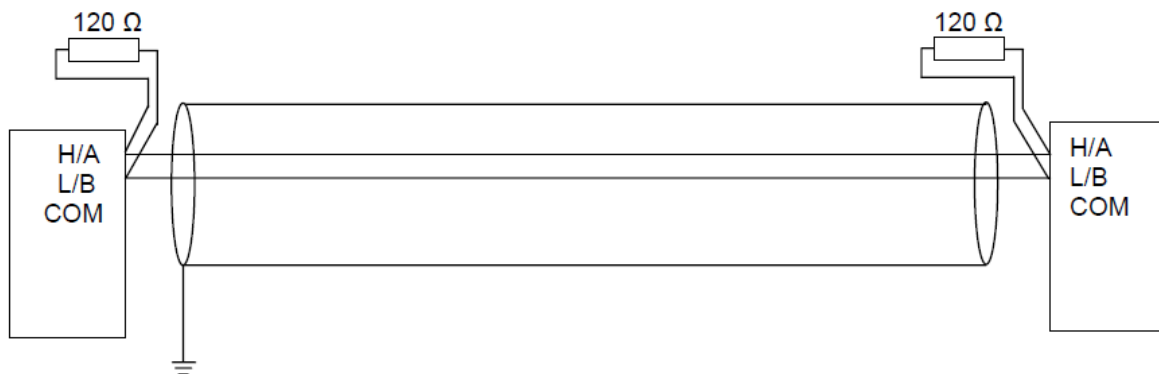
In some cases is necessary to use the optical isloation of RS485 line. Some modules has ebmaded optical isolation some needs aditional equipment to ensure the required separation. The need of galvanic separation depends on distance between the nodes and surrounding of transmittion line. See the table of recommended connection of RS485.

Surrounding/Powersupply	Distance between two nodes / the need of galvanic separation		
	<15m	15 -100 m	>100m
Same power supply No disturbance	no optical isolation	on one end	on one end
Same power supply High disturbance	on one end	on both ends	on both ends
Diferent power supply No disturbance	on one end	on one end	on both ends
Diferent power supply High disturbance	on both ends	on both ends	on both ends

Availability of embedded galavanic separation of RS485 port in ComAp products	
All IGS-NT controllers - port RS485(1)	NO
All IGS-NT controllers - port RS485(2)	YES
IG-Display, IS-Display - port RS485	YES
InteliVision 8 - port RS485, CAN	YES
InteliVision 5 - port RS485	NO
InteliVision 5 RD - port RS485	YES
InteliVision 5 CAN - port CAN	YES

Termination Resistors:

Because each differential pair of wires is a transmission line, you must properly terminate the line to prevent reflections. A common method of terminating a two-wire multidrop RS-485 network is to install terminating resistors at each end of the multidrop network. If you daisy-chained multiple instruments together, you need a terminating resistor at only the first and last instruments. The terminating resistor should match the characteristic impedance of the transmission line (typically 100–120 Ohms).
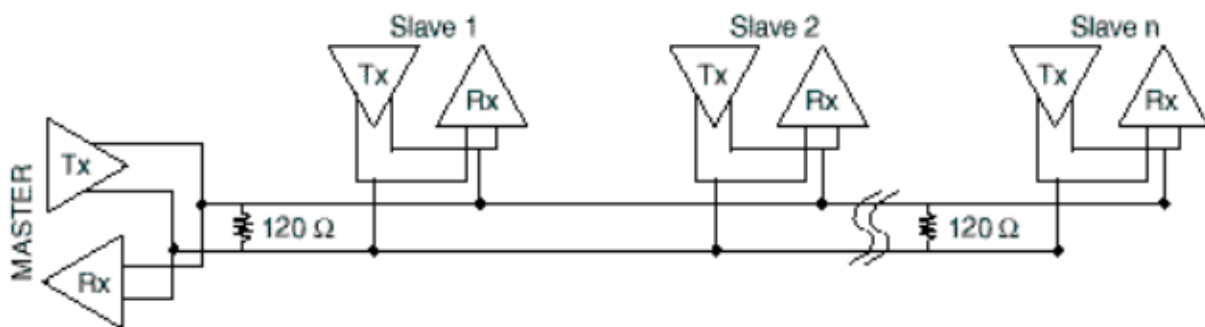
Bias Resistors:

The transmission line into the RS-485 port enters an indeterminate state when it is not being transmitted to. This indeterminate state can cause the receivers to receive invalid data bits from the noise picked up on the cable. To prevent these data bits, you should force the transmission line into a known state. By installing two 620 Ohm bias resistors at one node on the transmission line, you can create a voltage divider that forces the voltage between the differential pair to be less than 200 milli-Volts, the threshold for the receiver. You should install these resistors on only one node. The figure below shows a transmission line using bias resistors. Bias resistors are placed directly on the PCB of controller. Use jumpers PULL UP / PULL DOWN to connect the bias resistors.
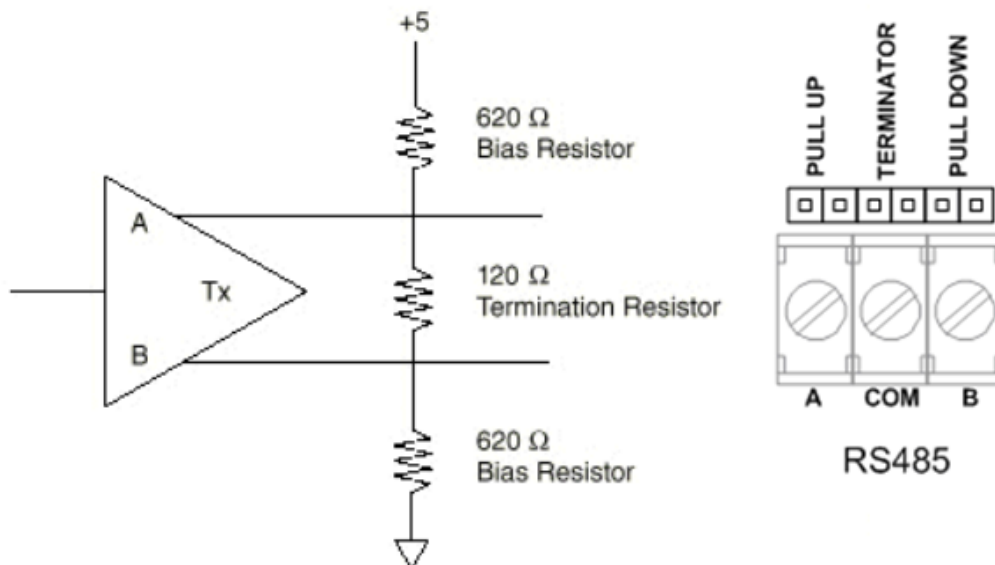
Modem Recommendations

The controller has to be connected to modem via standard modem cable where the DSR (Data Send Ready) signal detects modem presence (ComAp order code AT-LINK CABL).

Hint:
It is recommended to use the same type of modem on the both sides (and PC) of connection.
For GSM modem proper set-up use automatic ComAp GSM set-up software from the installation package. Setup software runs independently. In MS Windows select: Start - Program files – Comap – Tools – Gm_setup.exe

Analog Modem with DC Supply

Devolo Microlink 56k I is designed for the industrial applications. Power supply range is 9 - 30 V AC and 9 - 42 V DC. See http://www.devolo.de/.
INSYS Modem 56k small INT 2.0, 10-32 VDC. See www.insys-tec.cz.

Recommended ISDN Modem

Askey TAS-200E (power supply 12 V DC)
ASUScom TA-220ST
Devolo Microlink ISDN i

Hint:
The ISDN modems must work in the X.75 or V.120 protocols. The internet connection (HDLC-PPP) does not work.

Recommended CDMA Modem

Maxon MM-5100, 800MHz, 1xRTT (tested in Australia)
AirLink Raven XT (tested in USA)

Hint:
The usage possibility depends on the network type.

Recommended GSM Modems

Siemens M20, TC35, TC35i, ES75, MC39 (baud rate 9600 bps), TC65.
Cinterion MC75i (supported in FW IGS-NT ver. 2.5 and higher)
Cinterion MC55i (supported in FW IGS-NT ver. 2.5.1 and higher)
ONDA M01 (supported in FW IGS-NT ver. 2.5.2 and higher)
Wavecom M1200/WMOD2 (baud rate 9600 bps).
Wavecom - Maestro 20, dual 900/1800MHz.
Wavecom – Fastrack M1306B (GSM/GPRS CI.10 Modem), dual 900/1800 MHz (Fastrack M1206B is **NOT** recommended)
FALCOM A2D, dual 900/1800MHz.
CEP GS64 Terminal
Wavecom Fastrack Supreme 10

GSM modem wiring notes – IG/IS-NT

IG/IS-NT controllers provide a possibility to select whether a modem with active DSR signal (full modem cable connection - RXD, TXD, GND, RTS, CTS, DSR and DCD control signals available) or without this signal (3 wire connection – RxD, TxD and GND signals available) is connected.

In the controller the selection is done by **Comms settings**:*RS232(1/2) mode* setpoint.
Select MODEM (HW) for full cable connection or MODEM (SW) for 3 wire connection.

Place I-LB jumper "HW/SW control" when MODEM (SW) connection is selected.
Hint:
Make sure all signals are connected and activated in modem when it is not possible to open connection.
Some types of GSM module have jumpers select table control and handshaking signals.
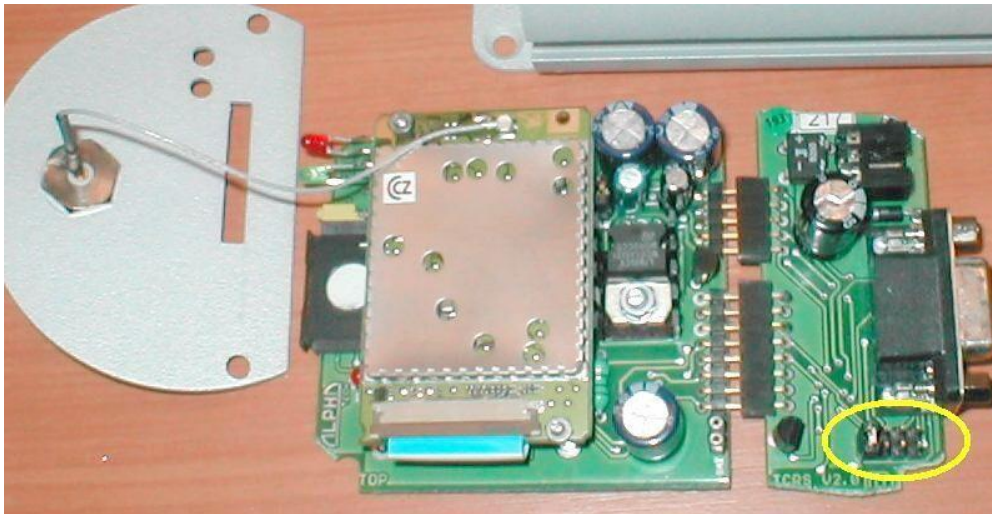
TC35 Alphatech GSM modem: the first jumper from the left is closed.

GSM Modem setup

Prior to start work with GSM modem run following program for GSM proper setup.
Program writes all the necessary AT commands to configure the GSM modem properly for use with IG-CU or IS-CU.

This program runs independent on other PC SW:
- Start MS Windows-Start-Program files – Comap – Tools – Gm_setup.exe.
- Select COM port
- Tick ☐ when GSM will be used with old iG-MU unit
- Press <u>S</u>etup button
- Follow commands in GSM Modem Setup window
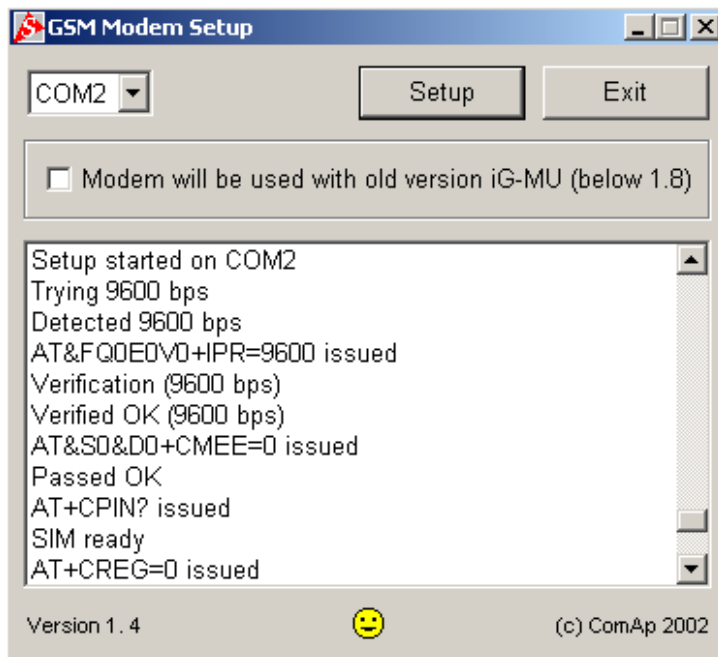
Selection "Modem will be used with old version of IG-MU (below 1.8)" sets GSM modem Baud rate to 38400 bps !!!

It is strongly recommended to use the same type of modem at both sides (IG and PC) of connection.

When modem **TC35i** does not respond for sending command SMSes, do the following:
1. Send **AT+CPMS="MT","MT","MT"** command via hyperterminal
   or by means of RS232()MdmIni parameter.
2. Send **AT+CPMS="SM","SM","SM"** command via hyperterminal
   or by means of RS232()MdmIni parameter.
3. Restart the modem.

Mobile Phone SIM Card Setting

Adjust SIM card on GSM modem in the following way:
- Enable data communication (it could be done by your local GSM operator),
- Set phone number SMS service center SC (recommended in international format in case of roaming),
- Set no PIN code required.

Hint:
All SMS on SIM card will be erased during GSM modem initialization. Valid SMS on SIM card will be served. Except of adjusting and gen-set control command.
Both SIM cards must have DATA services enabled when communicating from controller to PC via two GSM modems. The GSM tariff should have CSD (Circuit Switch Data) service enabled.

How to check SIM card DATA setting

- Move SIM card from controller GSM modem to Mobile phone.
- Call from InteliMonitor to this Mobile phone and check (on Mobil phone) DATA call indication of incoming call.
- If phone does not indicate DATA - solve this with your GSM operator.

3G Modems

The functionality of 3G modems with Comap controllers depends on the operator and his network settings. Therefore it is recommended to first test the controller with such modem.

Recommended Satellite Modems

Thrane & Thrane EXPLORER series http://www.thrane.com/
Wideye SABRE series http://www.wideye.com.sg/

Converters

Converter RS232 ↔ RS485
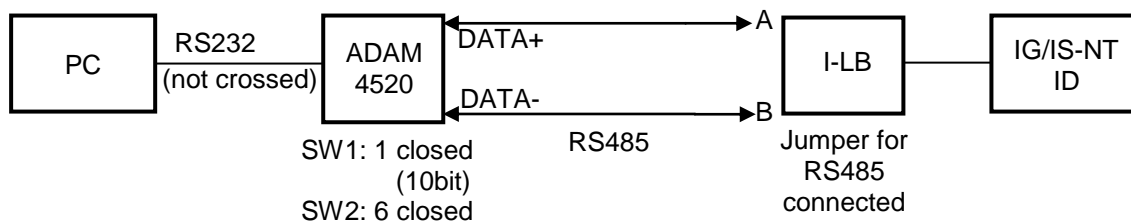
General properties of RS232 to RS485 converters:
- Has to be set to passive DSR signal (when DSR connected) after switch on.
- No external data flow control signals are allowed – automatic data flow control required.

Recommended converters

- External:
  ADAM 4520,
  ADVANTECH, (http://www.advantech.com/)
  - DIN rail, automatic RS485 bus supervision, no external data flow control signals, galvanic isolated, baud rate 19200 bps
  - When communication is working the LED on ADAM 4520 is going from full illumination to short darkness then again full illuminated
  - When communication of I-LB is working, PWR and RUN LEDs full red illuminated; TxD and RxD flashing when transmitting
- Internal for PC:
  PCL-745B or PCL745S,
  ADVANTECH, (http://www.advantech.com/)
  (Dual port RS422/485 Interface card, automatic RS485 bus supervision, no external data flow control signals, galvanic isolated, baud rate 19200 bps)

RS232 Bluetooth adapter
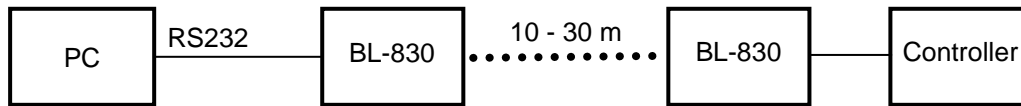
Recommended adapter

BL-830 (http://www.brainboxes.com/category/bluetooth.aspx) – doesn't work with Windows Vista
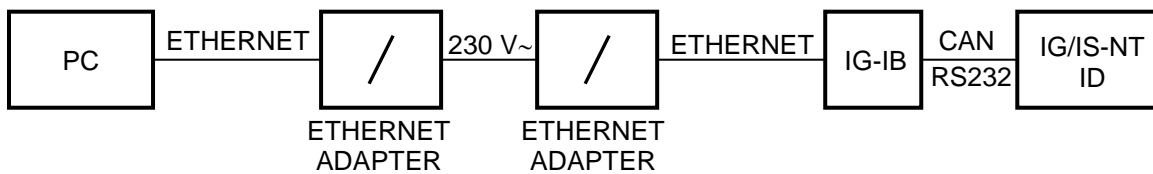
Converter 230V AC ↔ TCP/IP

- For installations where IG-IB is used but internet connection is not available
- The connection can be established using electric grid (230V AC) using Ethernet/230VAC converters
- Can be used for distances up to 200 meters

Recommended converter

- Powerline Ethernet Wall Mount,
  Corinex Communications (http://www.corinex.com/)

Example
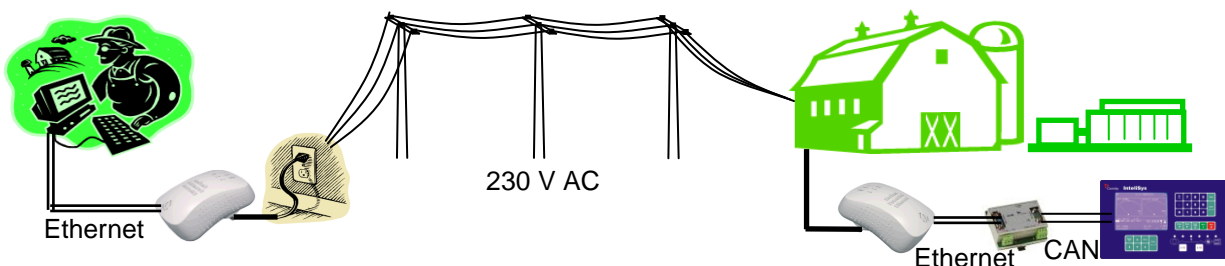
Converter USB ↔ RS232
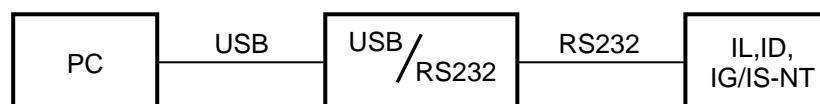
- Useful for PC/laptops without serial port

Recommended converters

- **UCAB232 Full**,
  ASIX (http://www.asix.cz/)
  UCAB232 is designated for all standard RS232 devices (mouses, modems, data terminals, barcode readers, serial printers) and industrial applications. UCAB232 supports Baud rates from 300 Bd to 250 kBaud (guaranteed) / 500 kBaud (typ.).
- **VPI - USS-101/111**,
  VPI (http://www.vpi.us/usb-serial.html)
  Supports serial devices with speeds up to 230kb/sec (e.g. PDAs, modems, scanners, etc.).
- **C-232-MM**,
  (http://www.usbgear.com/item_288.html)
  The USB Serial Adapter provides instant connectivity with modems, ISDN TAs, PDS, handheld & pocket PCs, digital cameras, POS, serial printers, etc. It supports data rates up to 230 Kbps.

Converter USB ↔ RS485

- Extends distance between PC and controller up to 1200 meters

PC	USB	USB/RS485	RS485	RS485/RS232	RS232	IL,ID, IG/IS-NT
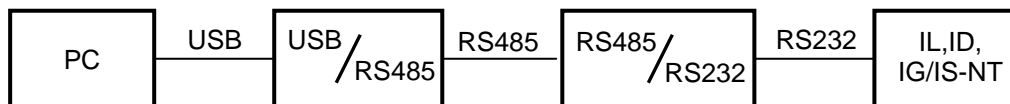
Recommended converter

- SB485S, SB485C, SB585L
  PaPouch elektronika
  (http://www.papouch.com/)

Converter Modbus RTU ↔ TCP
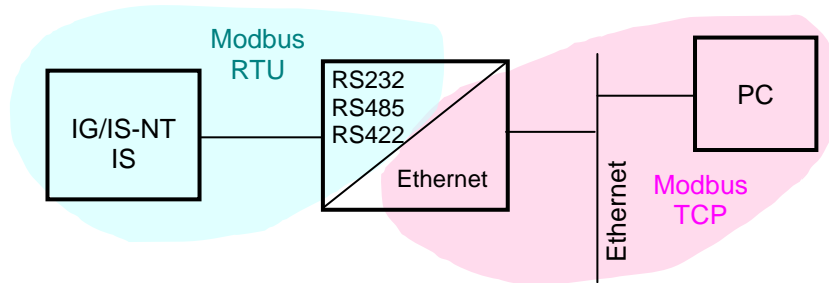
- For connecting of Modbus serial devices (e.g. Inteli controllers) to an Ethernet network

Recommended settings

Controller:

IG/IS-NT
Comms settings: *RS232(1) mode / RS232(2) mode** = MODBUS-DIRECT
Comms settings: *RS232(1)MBCSpd / RS232(2)MBCSpd** = 9600 / 19200 / 38400

When using RS485 don't forget to set also
Comms settings: *RS485(1)conv. / RS485(2)conv.** = ENABLED

* Second RS232/485 port available only in IG-NTC/EEC and IS-NT.

IS-CU
Basic settings: *RS232 mode* = MODBUS

Only Baud rate 9600 bps available in IS-CU.

Isolator RS232

- For galvanic separation of the line between Inteli controllers and PC
- Useful when different ground potentials are present

Recommneded isolators

- UC232,
  PaPouch elektronika (http://www.papouch.com/)

The isolator UC232 can be used instead of UC232-7. The only difference is that UC232 needs external power supply. It can be 5V stabilized or 7-17V unstabilized. The power supply voltage must be specified in the order. Suitable 5V power supply is also available from the Papouch company.

- UC UC232-7,
  PaPouch elektronika (http://www.papouch.com/)

Recommended optical USB extension cables

- Opticis M2-100-xx http://opticis.com
- USB Rover 200   http://www.icron.com
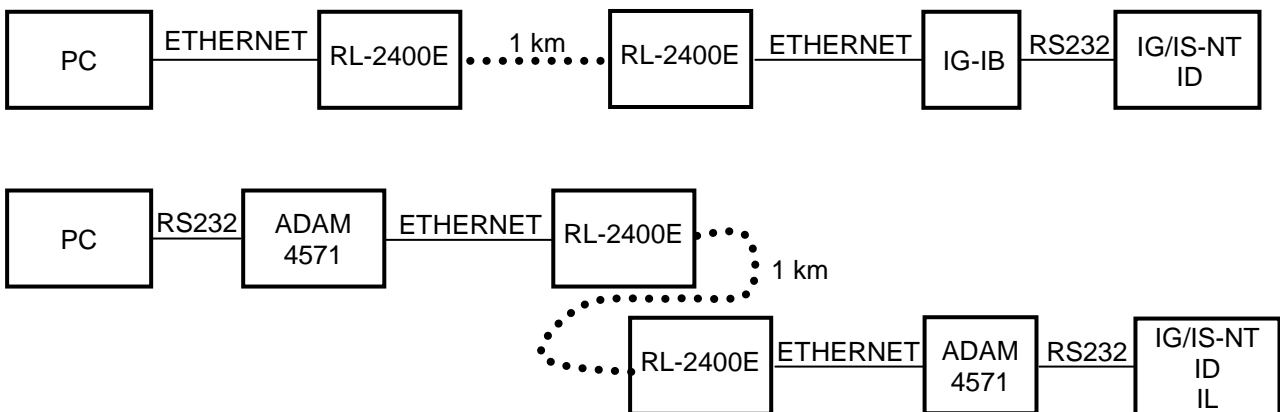
Radio Link

- Useful when the control room is distant from the site
- Can be more economical than to hard wire it

Recommended equipment

- RadioLinx RL-2400E wireless Ethernet switch, ProSoft Technology Inc. (www.prosoft-technology.com)
- ADAM-4571, ADVANTECH (www.advantech.com)
- MOXA DE311, MOXA (www.moxa.com)
- MOXA Nport 5230, MOXA

Converter Modbus RTU ↔ SNMP
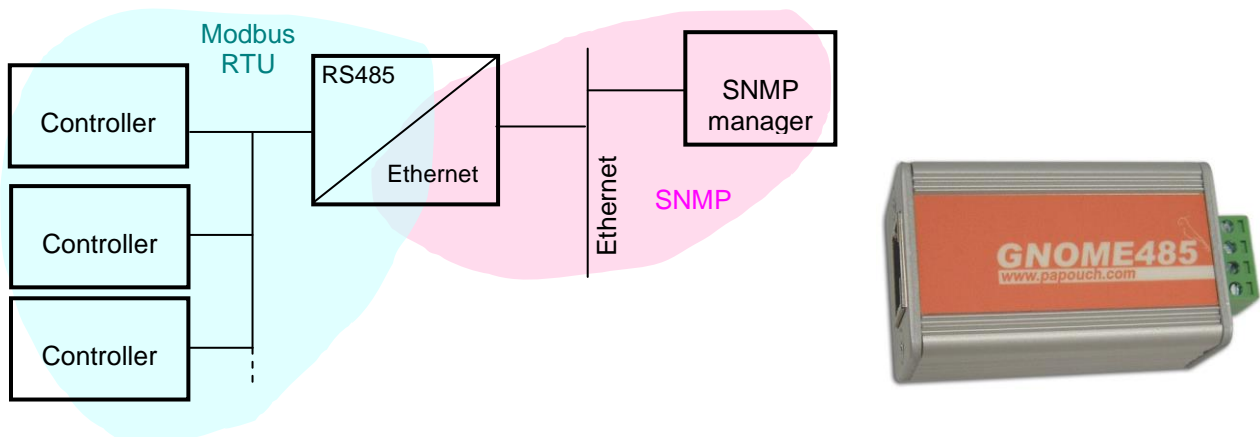
- For connection of 1-32 IG/IS-NT (stadard line) controllers to a SNMP supervision system
- Supports GET, SET, TRAP transactions
- 3rd party product GNOME485 Dimensions - 56 (63 with connector) x 24 x 33 mm

Hint:

For testing purposes there is IG-NT controller with this converter on address 195.122.193.153 (controller address = 1). Appropriate MIB table is available on www.comap.cz.

MIB Table

The MIB table contains following data objects
Read only:

Modbus Register(s)	Com.Obj.	Name	Dim	Type*	Decimals
40003	8253	Binary inputs		Binary16	
40012	8239	Binary outputs		Binary16	
40013	8213	Ubat	V	Integer16	1
40016	9155	Analog inp. 1 CU		Integer16	1
40017	9156	Analog inp. 2 CU		Integer16	0
40018	9157	Analog inp. 3 CU		Integer16	0
40168	9574	ControllerMode		Unsigned16	-
40249	8192	Gen V L1-N	V	Unsigned16	0
40250	8193	Gen V L2-N	V	Unsigned16	0
40251	8194	Gen V L3-N	V	Unsigned16	0
40256	8210	Gen freq	Hz	Unsigned16	1
40261	8204	Pwr factor		Integer16	2
40262	8395	Load char		Char	
40264	8202	Act power	kW	Integer16	0
40288	8195	Mains V L1-N	V	Unsigned16	0

Modbus Register(s)	Com.Obj.	Name	Dim	Type*	Decimals
40289	8196	Mains V L2-N	V	Unsigned16	0
40290	8197	Mains V L3-N	V	Unsigned16	0
40296	8211	Mains freq	Hz	Unsigned16	1
43589	8207	Num starts		Unsigned16	0
43587	8206	Run hours	h	Integer 32	0
46354		Num items alarmlist		Unsigned16	
46669		Item 1 alarmlist		String	
46694		Item 2 alarmlist		String	
46719		Item 3 alarmlist		String	
46744		Item 4 alarmlist		String	
46769		Item 5 alarmlist		String	
46794		Item 6 alarmlist		String	
46819		Item 7 alarmlist		String	
46844		Item 8 alarmlist		String	
46869		Item 9 alarmlist		String	
46894		Item 10 alarmlist		String	
46919		Item 11 alarmlist		String	
46944		Item 12 alarmlist		String	
46969		Item 13 alarmlist		String	
46994		Item 14 alarmlist		String	
47019		Item 15 alarmlist		String	
47044		Item 16 alarmlist		String	

Read / Write

43027	8315	ControllerMode		Unsigned16	
46359		Action argument		Integer32	

Write only

24470	24470	User identification number		Unsigned16	
24524	24524	Password		Unsigned16	
46361		Action command		Unsigned16	

* SNMI data types are INTEGER32 for all numerical values except "Run hours", which is GAUGE32. The column "Type" means how the data shall be interpreted.

Converter settings

Setup of the converter is done via TELNET at port **9999** instead of standard port 21. The default IP address is 192.168.1.254.

To enter setup mode:

1. Connect the converter to LAN
2. Put command "telnet 192.168.1.254 9999" to the windows command line on any computer connected to the same LAN

Setup procedure:

1. Press "0" key to change server configuration (converter IP address, netmask, gateway address etc..)
2. Press "1" key to change device configuration (read/write community, SNMP manager address*..)
3. Press "9" key to save parameters to the memory and exit setup mode

SNMP manager address is IP address of the device the TRAPs are addressed to.

Controller settings

IG/IS-NT
Comms settings: *RS232(1) mode / RS232(2) mode* = MODBUS-DIRECT
Comms settings: *RS232(1)MBCSpd / RS232(2)MBCSpd* = 57600
Comms settings: *RS485(1)conv. / RS485(2)conv.* = ENABLED

* Second RS232/485 port available only in IG-NTC/EEC and IS-NT.

Hint:
The converter provides communication only with controllers (addresses) that are present on startup of the converter. It means any controller powered-up later than the converter is not recognized and supported.
The converters are supposed to work with IG/IS-NT controllers of standard line (version 2.1 and higher), IC-NT and IL-NT controllers (standard branches).

Converter Modbus RTU ↔ Profibus
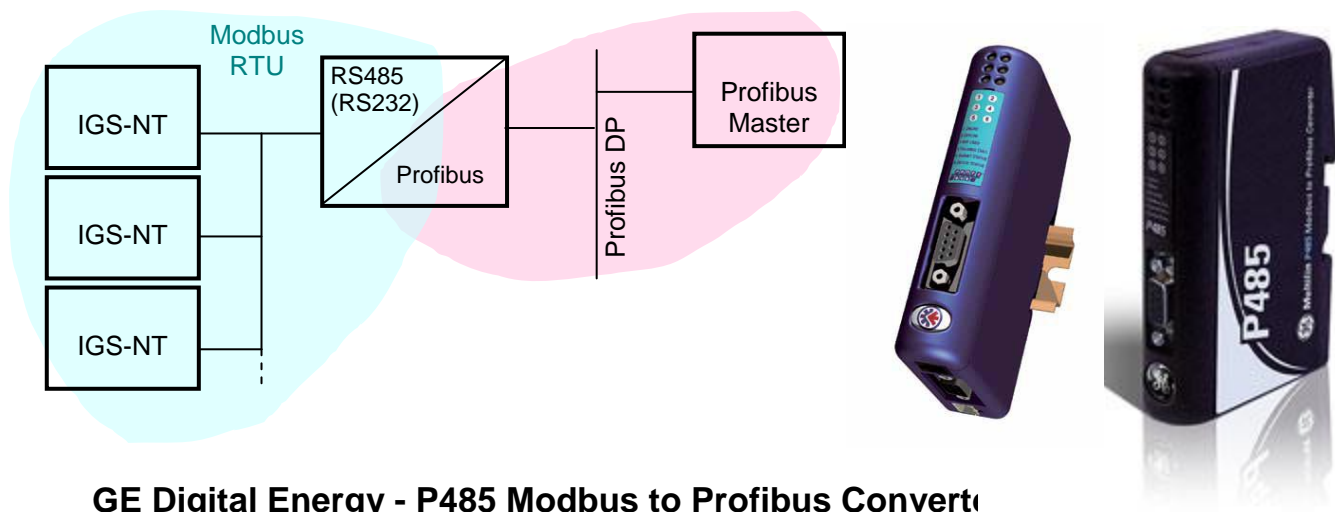
GE Digital Energy - P485 Modbus to Profibus Converter

- For connection of 1-32 NT line controllers to a Profibus network
- RS485 or RS232 physical layer for connection to the controller(s)
- Full Profibus-DP slave functionality according IEC61158
- 244 bytes input data size (122 Modbus registers)
- 244 bytes output data size (122 Modbus registers)
- 416 bytes total
- See deatils on the web page of the manufacturer:
  http://www.gedigitalenergy.com/multilin/catalog/p485.htm

Converter settings

- Use EnerVista software to setup the converter. It can be downloaded from the web page
  http://pm.geindustrial.com/download/download.asp?id=p485&file=1.
- To configure the converter in the Profibus network, download the description file
  http://www.geindustrial.com/products/software/d485/P48509E5.zip and import it to the Profibus configuration tool.

  Follow instructions in the P485 manual while configuring the converter. The setup wizard incorporated in the Enervista software will make the setup process much easier, but finally some

manual corrections are needed. Below are some notes specific to the connection with ComAp controllers.

1. The physical layer for Modbus communication is select table. The selected type (RS232/RS485) and speed must be same in the P485 and controller, see Controller settings.
2. Use RS485 in case more controllers are connected to the P485.
3. A *Device* mentioned in the wizard represents a controller type (IG-NT, IM-NT, IS-NT). Once a device is defined, more nodes of the same type (device) can be created easily.
4. A *modbus network node* represents a controller. The *slave address* must correspond to the Controller address setpoint of the related controller.
5. See Modbus Connection chapter in this document for details about Modbus, register numbers, sizes etc.
6. **Use triggered update mode for writing objects (registers) to the controller. Never use cyclic update mode!**

Setup example (using wizard):

1. Select wizard.

"Select the desired topic to do and press the OK button.
* A ""Wizard"" option will guide you through and explain all steps of a configuration.
The output from a wizard will result in a working configuration ready to download.
It is also possible to edit the configuration in the standard Enervista P485/D485 Setup program after
Wizard completion.
* The ""Blank Configuration"" option will open the standard Enervista P485/D485 Setup and a configuration can be created from scratch. Here it is also possible to open an existing configuration from file or via upload from a P485/D485 module."

☐ Don't show this Window again

2. Select fieldbus type.

3. Select physical layer and communication parameters for Modbus.
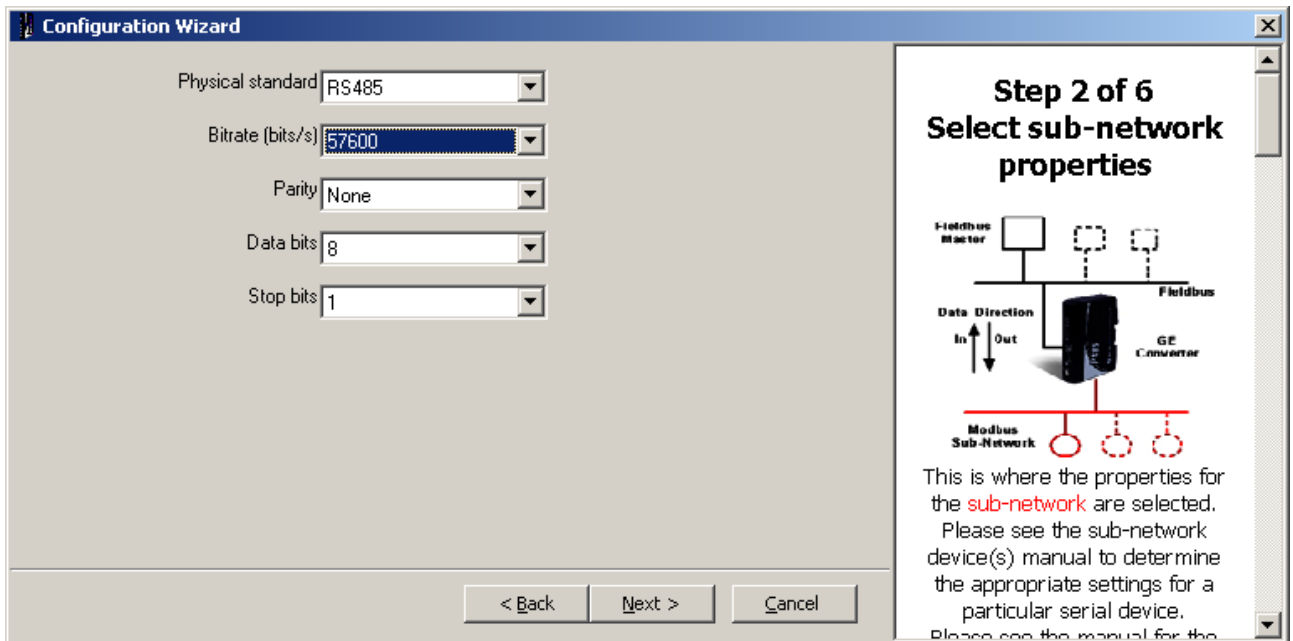
4. Define IGS-NT Device, it's Parameters and related Modbus registers.

5. Define nodes connected to the Modbus network.

6. For each node select parameters that have to be mapped to the Profibus network.
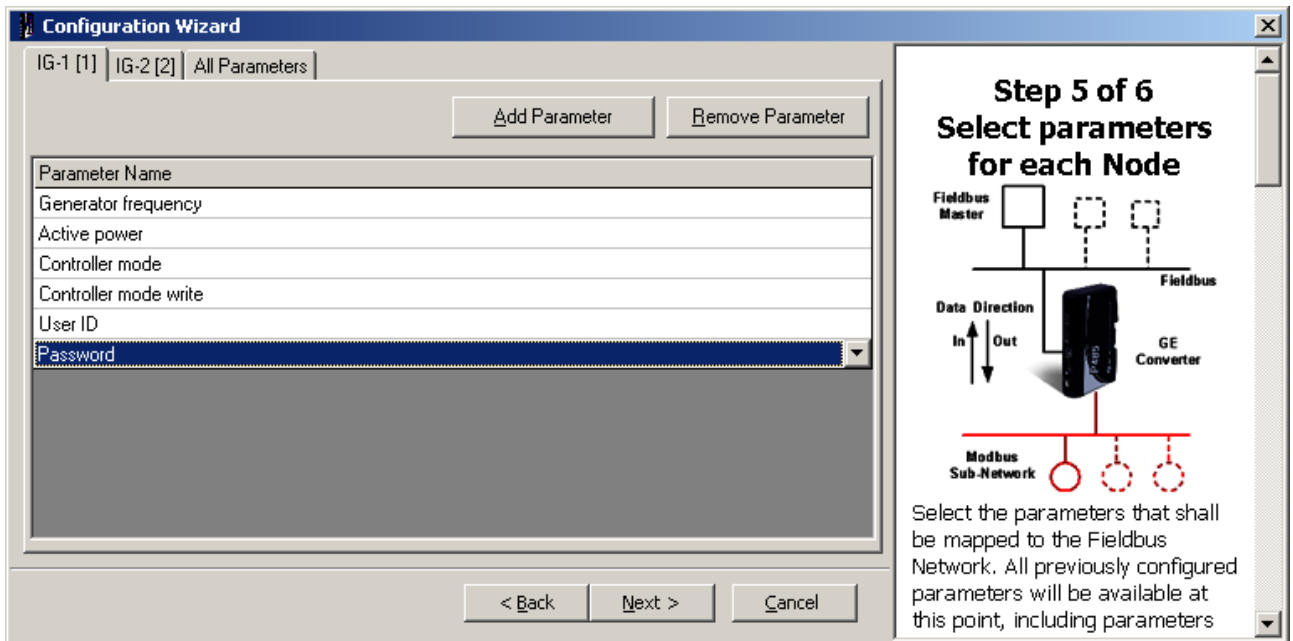
7. Save the configuration overview (the picture below is only a general example, not a real one).
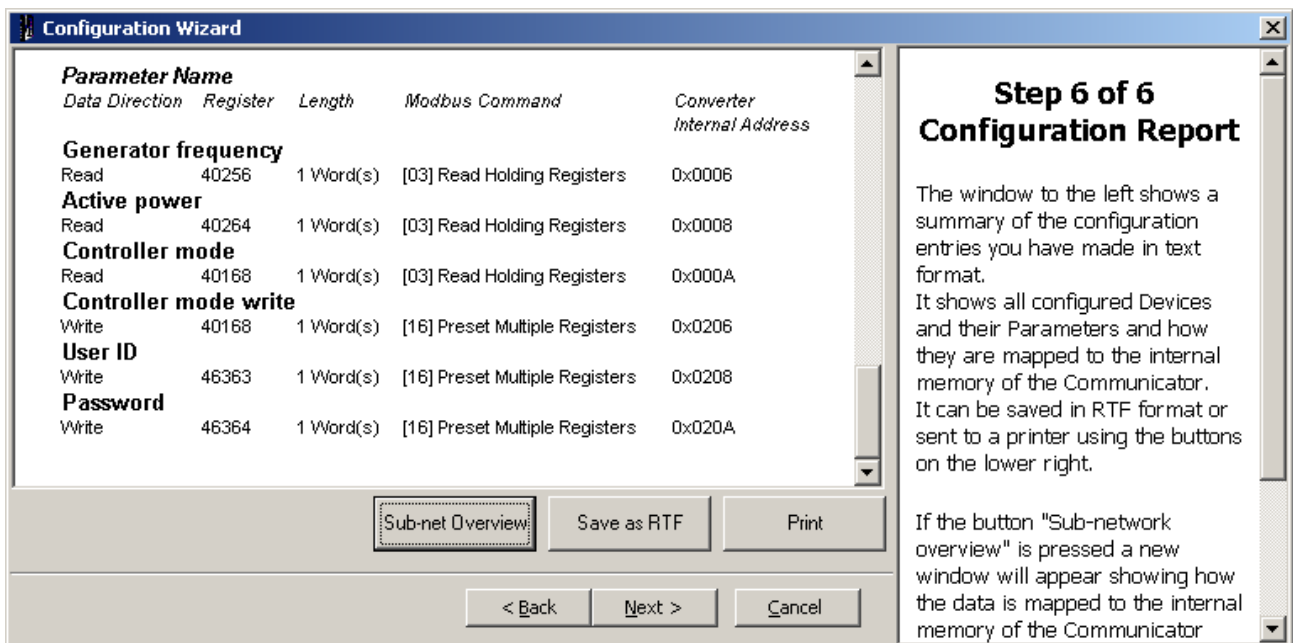
8. The configuration using wizard is finished.
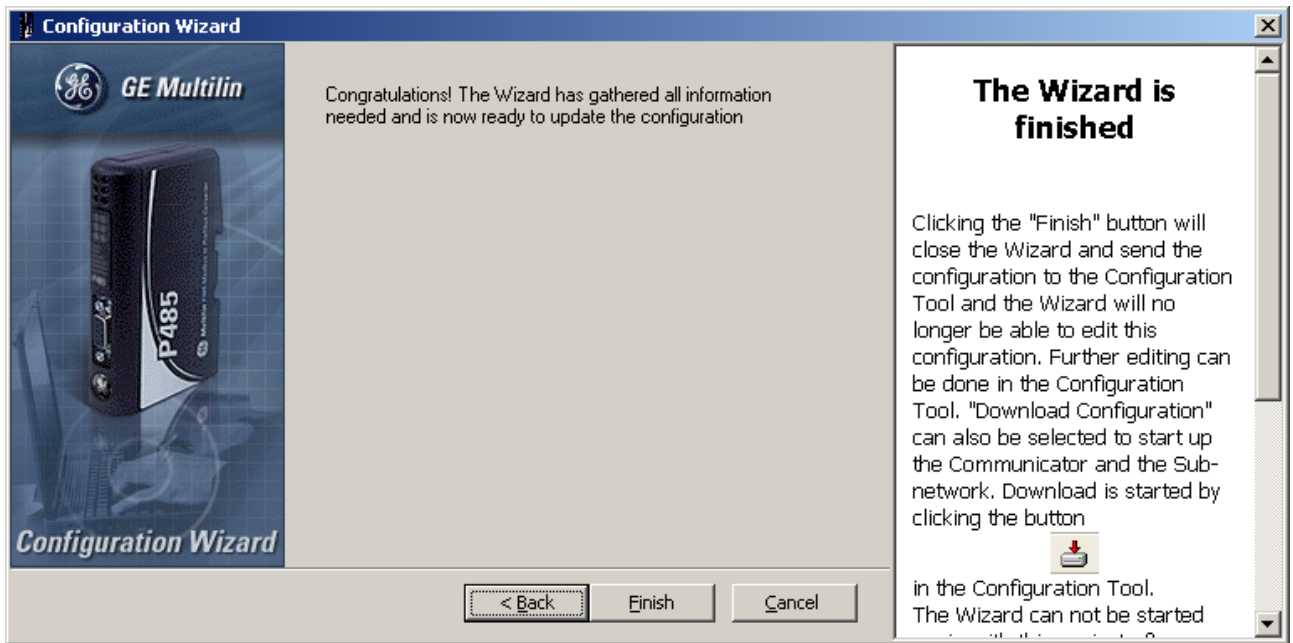
9. Save the configuration to a file.

10. Navigation window will appear:
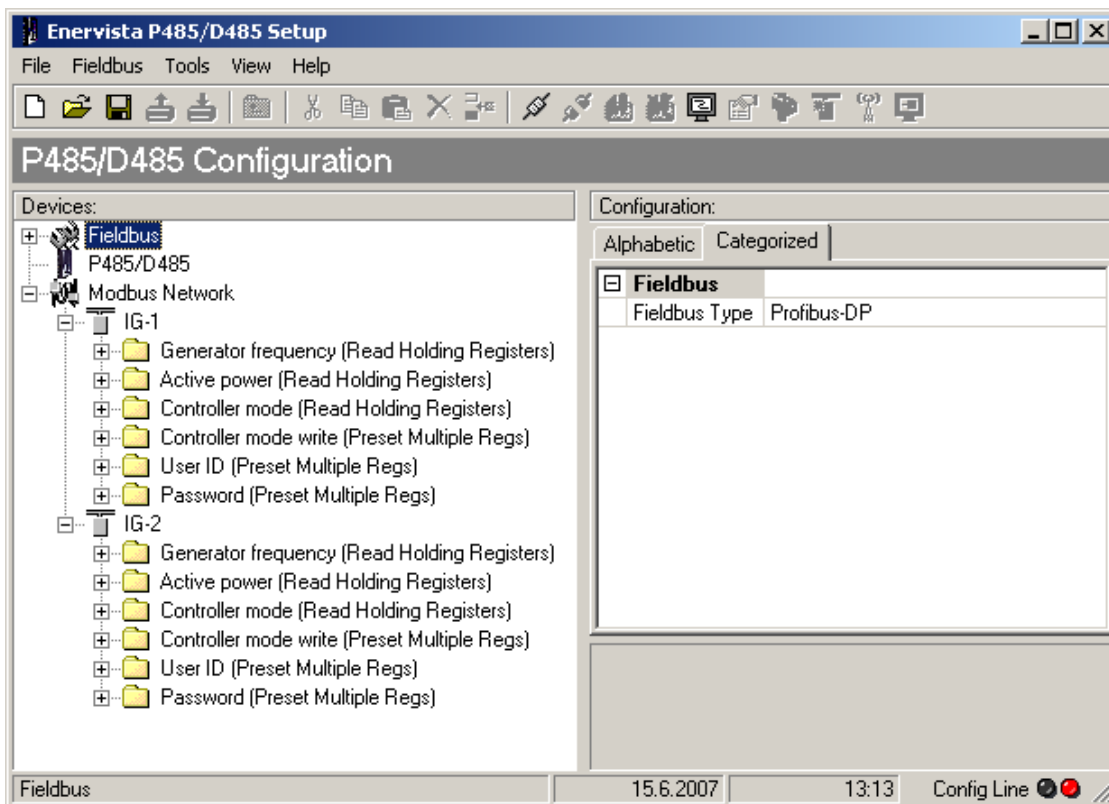
11. For each write-type parameter modify the property *Update mode* to triggered mode and define *trigger byte address*. The Profibus master must update the parameter data field first and then increase the trigger byte value to write the parameter (register) to the controller.
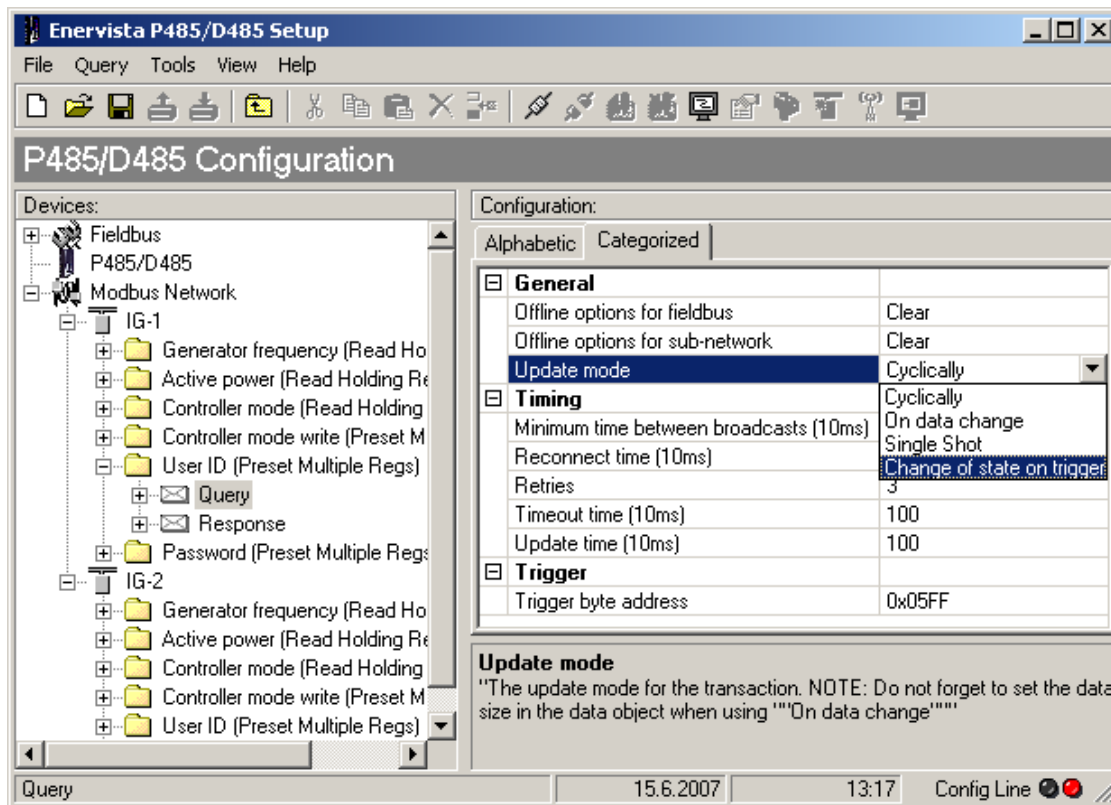
12. Write the configuration to the P485 and save it also to disk as backup.

Controller settings

IG/IS-NT
Comms settings: *RS232(1) mode / RS232(2) mode** = MODBUS-DIRECT
Comms settings: *RS232(1)MBCSpd / RS232(2)MBCSpd** = according to converter setting
Comms settings: *RS485(1)conv. / RS485(2)conv.** = according the converter setting

* Second RS232/485 port available only in IG-NTC/EEC and IS-NT.

Anybus Comunicator - Modbus RTU to Profibus and other communication standards converter

Anybus comunicator is converter from Modbus RTU (RS232, RS422, RS485) to Profibus and other communication standards. See more information on manufacturer web page.

- See deatils on the web page of the manufacturer:
http://www.hms.se/products/products.asp?PID=104&ProductType=Anybus%20Communicator

- Download user manual and configuration manual
http://www.hms.se/upload/104-0855-ABC-PDP_2_53.pdf

Ethernet converter from twisted pair (UTP/STP) to optic

- For galvanic separation
- For cable length extension

Recommended equipment

- Ethernet Media converters
  - MOXA IMC-21A (http://www.moxa.com/product/IMC-21A.htm)
    Multimode/single mode versions. One Ethernet port. Up to 40km (single mode). SC/ST connectors.

- Ethernet Switches
  - MOXA EDS-305/308 series (http://www.moxa.com/product/eds-308305.htm)
    Unmanaged switches. Multimode/single mode versions. 4/6 Ethernet RJ-45 ports, 1/2 optical ports. Up to 40km (single mode). Alarm contact. SC/ST connectors.

  - MOXA EDS-405A/408A series (http://www.moxa.com/product/eds-408405a.htm)
    Managed switches. Multimode/single mode versions. 4/6 Ethernet RJ-45 ports, 1/2/3 optical ports. Up to 40km (single mode). Redundant power supply. Alarm contact. SC/ST connectors.

SMS message commands

Controller address

Controller address is unique controller identification number located in setpoint group **Basic setting :** *Contr addr [1 to 32].*

Syntax: **#XX**
              XX … controller address [1 to 32]
Example: #5
              Message is addressed to controller with address 5.

Access code

InteliGen / InteliSys Access code is 15 characters length string. Access code is separated from controller address by column.

Syntax: #5**:X**
              X … controller access code up to 15 characters length
Example: #5:accesscode
              Message is addressed to controller with address 5 and its access code is set to value 'accesscode'.

Read value or setpoint

Command for reading of selected value or setpoint. Return value is in appropriate numerical or string format.

Syntax: **r XXXX** (or rXXXX)
              r   …   command
              XXXX…   value or setpoint code
Example: #5:accesscode **r 8252**
              Reading of setpoint 8252 (8252 = Gear teeth)

Hint:
Access code can't contain space character. Access code can be changed in InteliMonitor only.

Adjust setpoint

Command for adjusting of selected setpoint. Answer message contains only confirmation of successful adjusting or appropriate error.

Syntax: **w XXXX YYYY** (or wXXXX YYYY)
              w   …   command
              XXXX…   setpoint code
              YYYY…   value of setpoint in appropriate format
Example: #5:accesscode **w 8252 144**
              Adjusting of setpoint 8252 to value 144 (8252 = Gear teeth).

Return code: ok   …   adjusting setpoint was correct
              w_err   …   adjusting setpoint was not successful
              er_pass   …   adjusting setpoint required that valid password was entered
              er_old   …   command for adjusting was read out from SMS during GSM modem initialization – in this case command will not be served.

Enter password

Password setting command. Password has to be set before adjusting of protected setpoint or calling protected gen-set control command. Setting password command is not necessary before every adjusting. Password is a number in range 0 to 65535 and is valid for all rest of SMS.

Syntax: **p PPPP** (or pPPPP)
p   …   command
PPPP…   password

Example: #5:accesscode **p 1234**, w 8252 144
Setting password before adjusting protected setpoint.

Return code: ok   …   setting password was successful
er_pass …   setting password is not valid

Gen-set control

SMS command for invoking gen-set control command as Start, Stop, Fault reset etc.
Syntax: **c Y** (or cY)
c   …   command
Y   …   type of operation

Y	Type of operation	Y	Type of operation
1	Start	7	MCB ON
2	Stop	8	MCB OFF
3	Horn Reset	9	GCB ON/OFF
4	Fault Reset	10	MCB ON/OFF
5	GCB ON	11	Next Mode
6	GCB OFF	12	Previous Mode

Example: #5:accesscode p 1234, **c1**
This SMS command invokes gen-set Start. Password setting is needed in

case of password protection was configured for gen-set commands.

Return code: ok   …   gen-set command was accepted
er_pass   …   valid password was not set before executing the command
c?   …   unknown gen-set command
c_er   …   gen-set command execution is not allowed in actual state (e.g. attempt to start the gen-set in OFF mode).
er_old   …   command was read out from SMS during GSM modem initialization – in this case command will not be served.

Read Alarm list

Read actual Alarm list.

Syntax: **a**
a   …   command
Example: #5:accesscode **a**
Request of actual Alarm list.

Return code: AL=(items of alarm list) … comma separated items of Alarm list. Exclamation mark in front of Alarm list item indicates inverse record (still active alarm).

Note: 1. *Answer message contains at most eight items of Alarm list.*
            2. *Alarm list is not separated to more messages.*

Time delay

Insert time delay before serving next part of SMS command.

Syntax: **d T**
              d   …   command
              T   …   time delay in sec (in range 1 to 600)
Example: #5:accesscode **d 10**
              Request 10 sec delay before serving next SMS command.

Return code: d_ok   …   time delay was successful performed
              d_over   …   requested time delay is out of range (1 to 600 sec)

Note: *Any other SMS messages are not served during time delay!*

Remote switches (IG/IS-NT only)

Set or reset RemoteControl1-8 output.

Syntax: **s 1/0**
              s   …   command
              1/0 …   set/reset
Example: #5:accesscode p0, **s1 1**
              Enters password p0 and sets *RemoteControl1* output.

Return code: p_OK,s_OK

ExtValues (IG/IS-NT only)

Enters value to ExtValue.

Syntax: **e xxx**
              e   …   command
              xxx …   value
Example: #5:accesscode p0, **e1 50**
              Enters password p0 and sets *ExtValue1* = 50.

Return code: p_OK,e_OK

Help (IG/IS-NT only)

Request for list of supported SMS command.

Syntax: **?**
Example: #5:accesscode **?**
Return code: ?=(p <user:>passwd,r comm_obj,w com_obj val,c cmd_num,d sec,a,sx y,ex
              y,?)…...
              ..... list of supported SMS commands
Note: *Return code is not separated to more message.*

Answer message

Answer message start with # character followed by Gen-set name. Colon separates this header form return codes of SMS commands. Answer message is generated during serving of received message and is sent in case that 160 characters or end of received message are

achieved. Answer message is sent to the originator phone number. Tree dots at the end of message indicate separation and next following message.

Example: `#5:accesscode r8252,w8252 100,r8252`
answer message
`#Gen-setname: 144,ok,100`

Examples of SMS commands

Here is following several examples of SMS messages addresses to controller *IG/IS-NT* with address 5, named '*Gen-set name*'. Access code in this controller is set to '*accesscode*' and password is '*1234*'. In examples are used setpoints and values 8276 – Nomin.power, 10123 – RPM, 8315 – Controller Mode, 8235 – binary inputs, 8296 – Gen > f.

Example 1 – reading value

SMS:	S #5:accesscode r8276	*read value 8276*
Answer:	A #Gen-set name:100	

Example 2 – adjusting setpoint

SMS:	#5:accesscode p 1234, r8276,w8276 110,r8276	*read value 8276, write 110, read value 8276*
Answer:	#Gen-set name:ok,100,ok,110	*Password was accepted, read value of 8276 is 100, writing to 8276 was ok, new value of 8276 is 110*
	If wrong password sent: #Gen-set name:p_er,100, w_pass, 100	*Password was not accepted, read value of 8276 is 100 writing to 8276 was not successful read value of 8276 is still 100*

Example 3 – Gen-set control and delay time

SMS:	#5:accesscode r8276,c1,d30,r10123	*read value 8276, invoke gen-set command START, delay 30 sec, read value 10123*
Answer:	#Gen-set name:110,ok,d_ok,1499	*read value of 8276 is 110, Gen-set command START was accepted, confirm delay command, read value of 10123 is 1499*

Example 4 – adjusting special setpoint

SMS:	#5:accesscode r8315,w8315 0,r8315	*read value 8315, write 0 (index of stringlist type), read value 8315*
Answer:	#Gen-set name:MAN,ok,OFF	*read value of 8315 as string, writing was ok, read new value of 8315 as string*

Hint:

Setpoints Stringlist type (e.g. Controller Mode) is read as string and adjusted as index of string item in string list. e.g. Controller Mode:

Read value [as string]	Write value [as index]
OFF	0
MAN	1
SEM	2
AUT	3
TEST	4

Example 5 – reading and writing other type

S MS:	#5:accesscode r8235,w8296 110.2	*read value 8235, write 110.2 with decimal point*
A nswer:	#Gen-set name:OIIIOOIIO,ok	*read value of 8235 (binary value), writing was ok*

Note: *1. Writing of binary setpoint is not supported.*
    2. Writing of setpoint with decimal point is automatically converted to appropriate number of decimal places.

Example 6 – reading actual Alarm list

S MS:	#5:accesscode a	*read actual Alarm list*
A nswer:	#Gen-set name:AL=(!Wrn PrimWater temp, !Wrn SecWater temp, Batt volt)	*Actual Alarm list contains three items.*

Modbus Connection

Modbus protocol was implemented into the controllers to enable the customer to design its own supervision software.

Modbus Step by Step

```
┌─────────────────────┐      ┌─────────────────────┐      ┌─────────────────────┐
│   1. Connection     │      │   2. Setpoints      │      │  3. Communication   │
│                     │      │   (Comms settings)  │      │                     │
│    RS232            │ ═══▷ │                     │ ═══▷ │  Request            │
│    RS485            │      │   RS232 mode        │      │  Response           │
│    I-LB+ (RS232/485)│      │   RS232 MBCSpd      │      │                     │
│    Ethernet         │      │   RS485 conv.       │      │                     │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
```
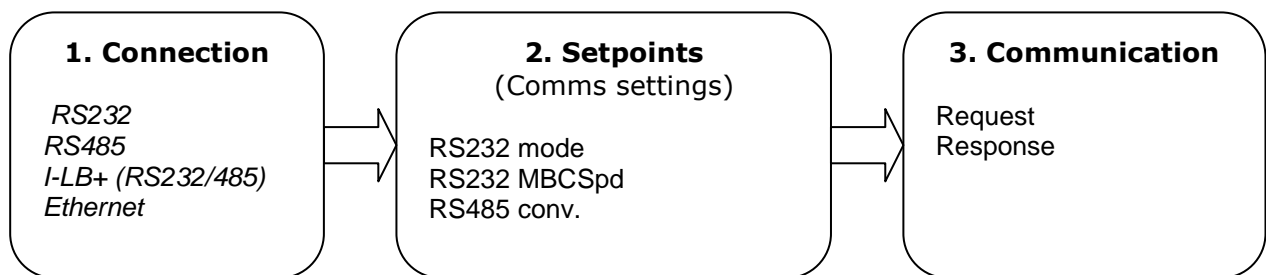
Important setpoints in the controller

There are three possibilities of Modbus connection to single or multiple controllers : Via RS232 or RS485, IG/IS-NT-BB controllers is possible connect via Ethernet port (TCP/IP ModBus).

Controller's configuration:
Comms settings: *RS232(1) mode* = [MODBUS-DIRECT]

Selection of Modbus communication speed:
Comms settings: *RS232(1)MBCSpd* = [9600 , 19200 , 38400 , 57600] bps

Selection of RS232/RS485 Converter:
Comms settings: *RS485(1)Conv.* = [DISABLED, ENABLED]

Ethernet connection settings are described in chapter Ethernet connection.

Modbus communication via RS232 – single controller

Controller's configuration:
Comms settings: *RS232(1) mode* = **MODBUS-DIRECT**
Comms settings: *RS232(1)MBCSpd* = **select of Modbus communication speed**
Comms settings: *RS485(1)Conv.* = **DISABLED**
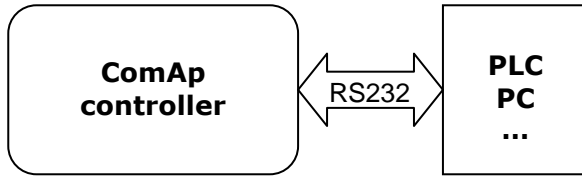
Modbus communication via RS485

Controller's configuration:
Comms settings: *RS232(1) mode* = **MODBUS-DIRECT**
Comms settings: *RS232(1)MBCSpd* = **select of Modbus communication speed**
Comms settings: *RS485(1)Conv.* = **ENABLED**
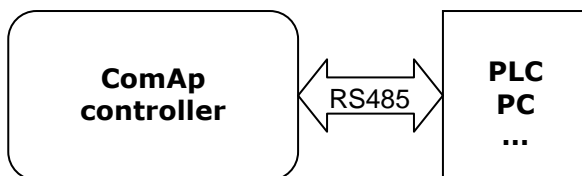
Hint:
The RS232/RS485 converter is included in the IG-NTC, IG-EEC and IS-NT controllers (no external RS232/RS485 converter is needed).

Hint:
RS485 communication line has to be terminated by 120 ohms resistors at both ends – follow converter user manual. RS485 communication can be used for monitoring and controlling of many controllers via InteliMonitor.

Modbus communication via RS485 – multiple controllers

Controller's configuration:
Comms settings: *RS232(1) mode* = **MODBUS-DIRECT**
Comms settings: *RS232(1)MBCSpd* = **select of Modbus communication speed**
Comms settings: *RS485(1)Conv.* = **ENABLED**
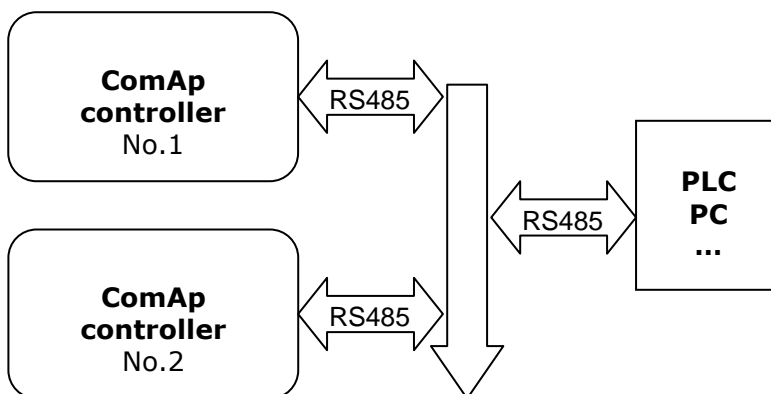
up to 32 controllers

Modbus communication via I-LB

I-LB / I-LB+ configuration:
Jumpers P13, P14 = **select of Modbus communication speed**
Jumper P16 = **Modbus**
Jumper P17 = **Address 1 or Address 2**
Jumper P18 = **Direct**
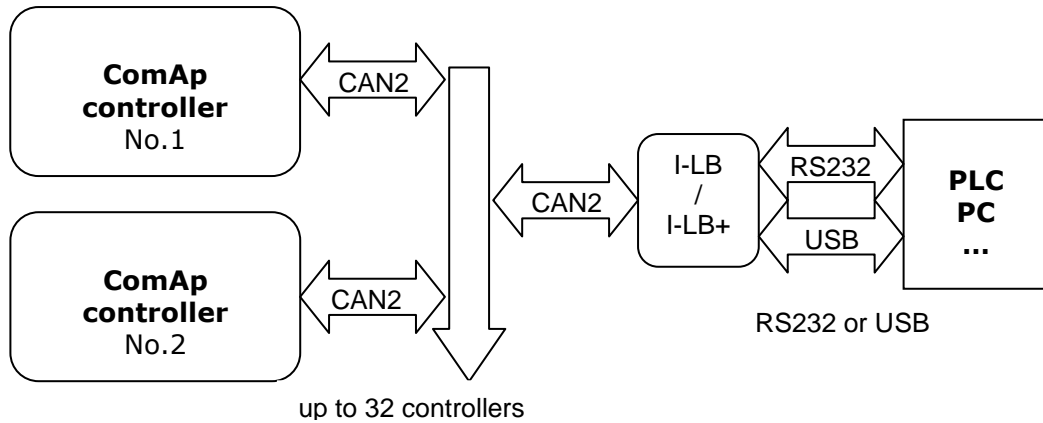
Hint:
To use I-LB Modbus communication connect Modbus jumper in I-LB unit (P16). Additionally, you can choose the communication speed using the speed selection jumpers (P13, P14). Their combination allows the speed selection of 9600 / 19200 / 38400 / 57600 bps.

Hint:
IG-IB communication unit doesn't support Modbus/TCP protocol!

Modbus Communication

Hint:
It is possible to define your own Modbus register numbers for any value or setpoint in the BaseBox controllers with standard FW v3.0 (IG-NT-BB, IS-NT-BB and IM-NT-BB firmware) and higher. For more information about this function please refer to the chapter User Modbus.

Hint:
In the firs time, you have to correctly configure the controller connection.

Data reading

The function Read Multiple Registers has to be used for data reading. The terminal sends a query and from the controller receives either the normal response containing the requested data or the exceptional response indicating a read error.

- It is possible to use function 3 for reading (*Read Multiple Registers*).
- It is not possible to read from the middle. The register number must correspond with the beginning of the data object. The only exception are the objects of „multipacket values" (registers 46367 – 46491) and „data part of the history record" (registers 46543 – 46667).
- All read registers must be implemented. If an unimplemented register appears among the read registers, the controller returns an error message.
- Even unnamed values can be included among read registers (See Cfg image - column Name = (N/A)). The read value must be treated as meaningless.
- The length of a block is 127 registers.

Data writing

All data can be written by the function Write Multiple Registers. Data up to 2 bytes can be written by the function Write Single Register, too. The terminal sends a query containing a written data and the controller either confirms it (normal response) or refuses it (exceptional response).

- For writing it is possible to use function 6 (*Write Single Register*) or function 16 (*Write Multiple Registers*).
- Using function 16 it is possible to write maximum 16 registers at once.
- Data cannot be written from the middle. Register number must correspond with the beginning of the data object. Written data must be complete to perform writing of all requested data objects.
- Writing to EEPROM is executed using a queue. The queue is common for writing from all terminals. The request for next writing is accepted in case that there is empty space in the queue. Otherwise the controller returns an error message and the terminal must repeat the request.
- All written registers must be implemented. If an unimplemented register appears among the read registers, the controller returns an error message.
- It is possible to include also unnamed registers in the written sequence
(See Cfg image - column Name = (N/A)). The controller confirms this writing but writing of unnamed registers is not performed.

Request :

- controller address (1 - 32), you can set or check your controller's address in the controller setpoints. *Setpoints -> Comms settings -> Contr.address*
- Modbus function code, you can use the 3, 6, 16 Modbus function code,

> Function 3 (Read Multiple Registers)
> Function 6 (Write Single Register)
> Command 10
> Function 16 (Write Multiple Registers)

- Register address (40001 - 47168), it means Modbus address of controller communication object (setpoint, value, et al.). You can crate list of Modbus registers, if you can't find the register address in this list, see the table of dedicated communication objects.
- Number of registers (1 - 127). It means, how many registers you want read.
- CRC (no range)

After sent your request, you receive the response. The response has also five parts:
- Controller address (1 - 32), the same as the address in the request
- Modbus function code (3,6,16, …), mostly the same as in the request
- Length of data (1 - 127), here is specified the length of the received data
- Data (0 - FF), data are in the HEX form, length is defined above
- CRC (no range)

Modbus Protocol Description

- Direct connection:
  - RS232, RS485, (I-LB+)
  - 8 data bits
  - 1 stop bit
  - no parity
- Modem connection
  - 8 data bits
  - 1 stop bit
  - no parity
- Communication speed:
  - 9600 / 19200 / 38400 / 57600 bps
- Transfer mode RTU
- Function codes
  - o 3 (Read Multiple Registers)
  - o 6 (Write Single Register)
  - o 10 (Command)
  - o 16 (Write Multiple Registers)
- The response to an incoming message depends on the communication speed. The delay is not shorter than the time needed to send/receive 3 and ½ characters.

The complete description of Modbus communication protocol can be found in
http://modbus.org/docs/PI_MBUS_300.pdf
and
http://www.rtaautomation.com/modbustcp/files/Open_ModbusTCP_Standard.pdf.

Read Multiple Registers

Byte	Meaning	Note
0	Controller address	1 to 32
1	3	Modbus function code
2	Communication object number - upper byte (MSB)	See List of communication objects
3	- lower byte (LSB)	
4	Communication object length expressed by the number of registers - upper byte (MSB)	Greater than 0
5	- lower byte (LSB)	
6	Check field CRC - lower byte (LSB)	See Check field calculation
7	- upper byte (MSB)	

Standard response

Byte	Meaning	Note
0	Controller address	Same as in the query
1	3	Same as in the query
	Length of read data in bytes (L)	Number of registers * 2
3	Data of the 1st register - upper byte (MSB)	
4	- lower byte (LSB)	
5	Data of the 2nd register - upper byte (MSB)	
6	- lower byte (LSB)	
…		
L + 1	Data of the last register - upper byte (MSB)	
L + 2	- lower byte (LSB)	
L + 3	Check field CRC - lower byte (LSB)	See Check field calculation
L + 4	- upper byte (MSB)	

Exceptional response

Byte	Meaning	Note
0	Controller address	Same as in the query
1	131	Modbus fun.number + 128
2	2	See Error list
3	Check field CRC - lower byte (LSB)	See Check field calculation
4	- upper byte (MSB)	

Write Single Register

Query

Byte	Meaning	Note
0	Controller address	1 to 32
1	6	Modbus function code
2	Communication object number - upper byte (MSB)	See List of communication objects
3	- lower byte (LSB)	
4	Data - upper byte (MSB)	
5	- lower byte (LSB)	
6	Check field CRC - lower byte (LSB)	See Check field calculation
7	- upper byte (MSB)	

Standard response

Byte	Meaning	Note
0	Controller address	Same as in the query
1	6	Same as in the query

Byte	Meaning	Note
2 3	Communication object number - upper byte (MSB) - lower byte (LSB)	Same as in the query
4 5	Data - upper byte (MSB) - lower byte (LSB)	Same as in the query
6 7	Check field CRC - lower byte (LSB) - upper byte (MSB)	See Check field calculation

Exceptional response

Byte	Meaning	Note
0	Controller address	Same as in the query
1	134	Modbus fun.number + 128
2	2	See Error list
3 4	Check field CRC - lower byte (LSB) - upper byte (MSB)	See Check field calculation

Write Multiple Registers

Query

Byte	Meaning	Note
0	Controller address	1 to 32
1	16	Modbus function code
2 3	Communication object number - upper byte (MSB) - lower byte (LSB)	See List of communication objects
4 5	Communication object length expressed by the number of registers - upper byte (MSB) - lower byte (LSB)	Greater than 0
6	Length of written data in bytes (L)	Number of registers ∗ 2
7 8	Data of the 1st register - upper byte (MSB) - lower byte (LSB)	
9 10	Data of the 2nd register - upper byte (MSB) - lower byte (LSB)	
…		
L + 5 L + 6	Data of the last register - upper byte (MSB) - lower byte (LSB)	
L + 7 L + 8	Check field CRC - lower byte (LSB) - upper byte (MSB)	See Check field calculation

Standard response

Byte	Meaning	Note
0	Controller address	Same as in the query
1	16	Same as in the query
2 3	Communication object number - upper byte (MSB) - lower byte (LSB)	Same as in the query
4 5	Communication object length expressed by the number of registers - upper byte (MSB) - lower byte (LSB)	Same as in the query
6 7	Check field CRC - lower byte (LSB) - upper byte (MSB)	See Check field calculation

Exceptional response

Byte	Meaning	Note
0	Controller address	Same as in the query
1	144	Function code + 128
2	2	See Error list
3 4	Check field CRC - lower byte (LSB) - upper byte (MSB)	See Check field calculation

Alarm list reading

It is not possible to read alarm list simultaneously from more terminals. If the terminal starts reading, the reading is locked for other terminals. It is unlocked 5 seconds after last reading of alarm list. The locked terminal indicates to another terminal an error message.

The whole alarm list is stored in the cache memory at the moment of locking and the following reading of records is performed from this memory. Locking is done only while reading the first record. So the successive reading from the first to the last record is supposed.

Alarm list reading via Modbus

Since firmware version 2.5 and higher is possible to read alarm list via modbus as a binary attributes of protection states. For this function was reserved these ranges of registers.

Registers	Register addresses	Number of registers	Access	Daty type
45751 to 45875	5750 to 5874	125	Reading	Domain
45876 to 46000	5875 to 5999	125	Reading	Domain
46201 to 46325	6200 to 6324	125	Reading	Domain

Number of register of particular protection you can get as exporting of modbus registers list from GenConfig. Open an archive in GenConfig (ver. 2.5 and higher), open File menu and choose "Generate Cfg Image --> Modbus registers all" (see "How get numbers of ModBus communication objects" chapter). Open the list of modbus registers you have got and see registers with number according the table. Here you can see meaning of particular modbus registers. Each register carries informations about two protections (Protection#1 and Protection#2).

```
Register     Protection#2          Protection#1
==============================================================================
45754        Warning 7             Warning 8
45755        Warning 9             Warning 10
45756        SD 11                 SD 12
45863        Oil press             Water temp
45864        Fuel level            N/A
45925        BIN 1                 BIN 2
45926        BIN 3                 BIN 4
```

EXAMPLE OF MEANING OF MODBUS REGISTERS

Meaning of register content

```
Register map:

Bit 0-7 ................. Protection #1
Bit 8-15  ............... Protection #2

Bit 0-2 ................. Protection #1 Level 1
Value   Meaning
-----------------------------------------------------------------
0       Level 1 inactive
2       Level 1 active, confirmed
3       Level 1 active, blocked
4       Level 1 previously active, not confirmed yet
6       Level 1 active, not confirmed yet
7       Level 1 active, not confirmed yet, blocked
```

```
Bit 3-5 ................ Protection #1 Level 2
Value   Meaning
----------------------------------------------------------------------
0       Level 2 inactive
2       Level 2 active, confirmed
3       Level 2 active, blocked
4       Level 2 previously active, not confirmed yet
6       Level 2 active, not confirmed yet
7       Level 2 active, not confirmed yet, blocked

Bit 6-7 ................ Protection #1 Sensor failure
Value   Meaning
----------------------------------------------------------------------
0       Sensor failure not active
1       Sensor failure active, confirmed
2       Sensor failure previously active, not confirmed yet
3       Sensor failure active, not confirmed yet

Bit 8-10 ................ Protection #2 Level 1
Value   Meaning
----------------------------------------------------------------------
0       Level 1 inactive
2       Level 1 active, confirmed
3       Level 1 active, blocked
4       Level 1 previously active, not confirmed yet
6       Level 1 active, not confirmed yet
7       Level 1 active, not confirmed yet, blocked

Bit 11-13 ................ Protection #2 Level 2
Value   Meaning
----------------------------------------------------------------------
0       Level 2 inactive
2       Level 2 active, confirmed
3       Level 2 active, blocked
4       Level 2 previously active, not confirmed yet
6       Level 2 active, not confirmed yet
7       Level 2 active, not confirmed yet, blocked

Bit 14-15 ................ Protection #2 Sensor failure
Value   Meaning
----------------------------------------------------------------------
0       Sensor failure not active
1       Sensor failure active, confirmed (or not configured as protection)
2       Sensor failure previously active, not confirmed yet
3       Sensor failure active, not confirmed yet
```

Example

Register	Protection#2	Protection#1
45754	Warning 7	Warning 8
45755	Warning 9	Warning 10
45756	SD 11	SD 12
45863	**Oil press**	**Water temp**
45864	Fuel level	N/A
45925	BIN 1	BIN 2
45926	BIN 3	BIN 4

Register number **45863** carries informations about states of protections **Oil press** and **Water temp.**
For undersanding of particular bit meaning use previous register map according table bellow. The first

line contains numbers of bits of the registers, the second one contains values of particullar bits. Values of particullar sections are in third line, their meaninng is in the last line.

Level 1 = yelow level in protection settings
Level 2 = red level in protection settings

Protection#2 = *Oil press*								Protection#1 = *Water temp*							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	1	0	0	1	1	0	0	1	0	0	0	0	1	0
1		4			6			1		0			2		
Sensor failure active, confirmed (or not configured as protection)		Level 2 previously active, not confirmed yet			Level 1 active, not confirmed yet			Sensor failure active, confirmed		Level 2 inactive			Level 1 active, confirmed		

Meaning of particular bits

Bit	Value of bit = 0	Value of bit = 1
0, 3, 8, 11	protection is not blocked, if the condition for activation is fulfilled protection can be announced	the condition for activation of protection is fulfilled but protection is blocked
1, 4, 9, 12	protection is not active (condition for activation is not fulfilled)	protection is active (condition for activation is fulfilled)
2, 5, 10, 13	protection has not been announced (the protection is not active or is active but blocked or it was active previously and was confirmed)	protection has been announced (is active and not blocked and was not confirmed)

History reading

It is not possible to read history from more terminals simultaneously. Reading must be started by writing of an index of requested history record. If the index is not written it is not possible to read neither history header nor data part of the record. In this case the controller returns an error message. If the terminal writes the index of requested record, history reading is locked for other terminals (i.e. reading and writing of an index of requested record, reading of header and data part of the record). It is unlocked 5 seconds after the last history reading. Locked history is indicated to other terminals by an error message.

Requested history record is stored at the moment of locking in the cache memory and following reading is performed from this memory.

Note
History reading is not possible in some specific firmware versions. See the concrete firmware version and its New Feature Lists.

Check field calculation

The check field allows the receiver to check the validity of the message. The check field value is the Cyclical Redundancy Check (CRC) based on the polynomial $x^{16}+x^{15}+x^2+1$. CRC is counted from all message bytes preceding the check field. The algorithm of CRC calculation is introduced below on an example of a C language function.

```c
unsigned short count_CRC(unsigned char *addr, int num)
{
  unsigned short CRC = 0xFFFF;
  int i;

  while (num--)
  {
    CRC ^= *addr++;
    for (i = 0; i < 8; i++)
    {
      if (CRC & 1)
      {
        CRC >>= 1;
        CRC ^= 0xA001;
      }
      else
      {
        CRC >>= 1;
      }
    }
  }
  return CRC;
}
```

"0103000C0001" (hex)	
1 byte checksum	17
CRC-16	0x1244
CRC-16 (Modbus)	0x0944
CRC-16 (Sick)	0x2110
CRC-CCITT (XModem)	0xCE32
CRC-CCITT (0xFFFF)	0xC022
CRC-CCITT (0x1D0F)	0xFF0C
CRC-CCITT (Kermit)	0xCDAD
CRC-DNP	0x6CB2
CRC-32	0x4323C124

`01 03 00 0C 00 01`   Calculate CRC

Input type: ○ ASCII ⊙ Hex

Online CRC calculator: http://www.lammertbies.nl/comm/info/crc-calculation.html
Controllers use the CRC-16 (Modbus). Data in examples in this manual are in HEX format.

How get numbers of ModBus communication objects
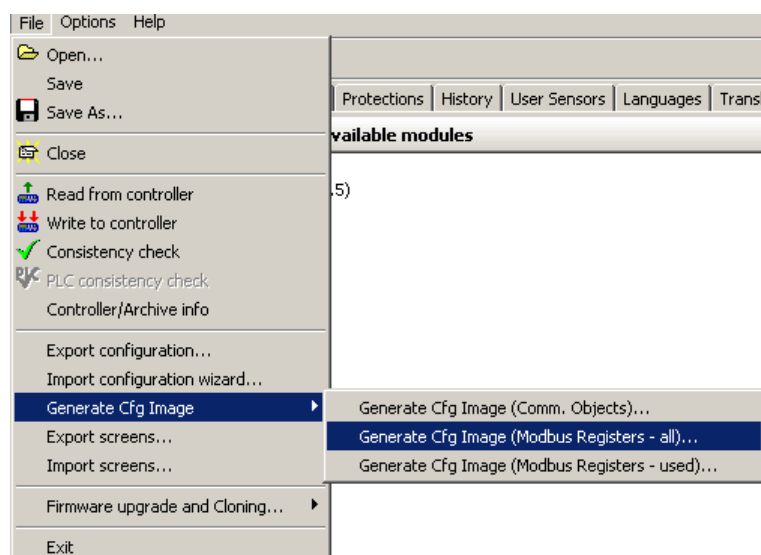
Communication objects can be spitted into two groups:
1. Communication objects dependent on the application type (SSB, SPM, SPtM, MEXT, MINT, …).
2. Communication objects independent on the application type.

Use GenConfig menu command File –> Generate Cfg Image –>

Generate Cfg Image (Comm. Objects …) and
Generate Cfg Image (Modbus Registers all/used).

```
     A part of Cfg Image (Modbus Register …) file
Register(s)       Com.Obj. Name          Dim   Type     Len Dec   Min    Max Group
40001             8505    (N/A)
40002             8506    (N/A)
40003             8235    BIN                  Binary#1   2   -     -      - Bin inputs CU
40004             9107    (N/A)
40005             9108    (N/A)
40006             9109    (N/A)
40007             9110    (N/A)
40008             9111    (N/A)
40009             9112    (N/A)
40010             9113    (N/A)
40011             9114    (N/A)
40012             8239    BOUT                 Binary#2   2   -     -      - Bin outputs CU
40013             8213    Ubat          V      Integer    2   1     0    360 Analog CU
40014             10124   CPU temp      °C     Integer    2   1  -200    800 Analog CU
40015             10603   Dplus         V      Integer    2   1     0    360 Analog CU
40016             9155    Oil press     Bar    Integer    2   1     0    100 Analog CU
40017             9156    Water temp    °C     Integer    2   0     0    150 Analog CU
40018             9157    Fuel level    %      Integer    2   0     0    100 Analog CU
40019             9158    Reload        s      Integer    2   0     0    200 Analog CU
43001-43008 ( 8)  8637    Gen-set name         String0   16   -     -      - Basic settings
43009             8276    Nomin power   kW     Unsigned   2   0     1  32000 Basic settings
43010             8275    Nomin current A      Unsigned   2   0     1  10000 Basic settings
43011             8274    CT ratio prim A      Unsigned   2   0     1  10000 Basic settings
43012             10556   CT ratio sec         List#9     1   -    41     42 Basic settings
43013             8566    Im3/ErFlCurCTp A     Unsigned   2   0     1  10000 Basic settings
43014             10557   Im3/ErFlCurCTs       List#9     1   -    41     42 Basic settings
43015             9579    VT ratio      V/V    Unsigned   2   1     1   5000 Basic settings
43016             10662   Vg InpRangeSel       List#10    1   -    43     44 Basic settings
43017             9580    Vm VT ratio   V/V    Unsigned   2   1     1   5000 Basic settings
43018             10663   Vm InpRangeSel       List#10    1   -    43     44 Basic settings
43019             8277    GenNomV       V      Unsigned   2   0    80  30000 Basic settings
43020             9673    GenNomVph-ph  V      Unsigned   2   0   130  60000 Basic settings
43021             9888    MainsNomV     V      Unsigned   2   0    80  30000 Basic settings
43022             9907    MainsNomVph-ph V     Unsigned   2   0   130  60000 Basic settings
43023             10647   VoltProtSelect       List#11    1   -    45     46 Basic settings
40163             9244    Engine State         List#1     1   -   429    449 Info
43025             8252    Gear teeth           Unsigned   2   0     0    500 Basic settings
.....             ....    .. . . ...           ... .      .   .   ...   .... .. . . .
```

```
Description of Cfg Image
```

Header	Descritpion
Registers(s)	Register number; register address = register number – 1
Com.Obj.	Corresponding communication object number
Name	Communication object name
Dim	Value dimension
Type	Value data type (see Data types)
Len	Data length in Bytes (max. 64)
Dec	Number of decimals
Min	Value low limit
Max	Value high limit
Group	Group of setpoints/values

Reserved communication objects

These objects are always available regardless of the controller software modification:

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46347 – 46348	6346 – 6347	2	read/write	Time	Actual time
46349 – 46350	6348 – 6349	2	read/write	Date	Actual date
46351	6350	1	read/write	Unsigned8	Language index selected for displaying of texts specified by data type String (# 7)
46352 – 4653	6351 – 6352	2	read	Domain	Code of the last communication fault See Error list
46354	6353	1	read	Unsigned8	Number of records in the alarm list
46355	6354	1	read	Unsigned16	Number of records in history (# 6)
46356	6355	1			Reserved (register not implemented)
46357	6356	1	read/write	Integer16	Index of requested history record (# 5)
46358	6357	1	write	Unsigned16	Remote key
46359 – 46360	6358 – 6359	2	read/write	Unsigned32	For writing:command argument For reading: command release value (# 3)
46361	6360	1	write	Unsigned16	Command (# 3)
46362	6361	1			Reserved (register not implemented)
46363	6362	1	read/write	Unsigned8	User identification number (# **4**)
46364	6363	1	write	Unsigned16	Entering of password for writing (# **4**)
46365	6364	1			Reserved (register not implemented)
46366 – 46490	6365 – 6489	125	read	Domain	Values multipacket(#8)
46491	6490	1			Reserved (register not implemented)
46493 – 46541	6492 – 6540	50	read	String	Header of the particular history record (# 1)
46542	6541	1			Reserved (register not implemented)
46543 – 46667	6542 – 6666	125	read	Domain	Data part of the particular history record (# 2)
46668	6667	1			Reserved (register not implemented)
46669 – 46693	6668 – 6692	25	read	String	1. record in alarm list (# 1)
46694 – 46718	6693 – 6717	25	read	String	2. record in alarm list (# 1)
46719 – 46743	6718 – 6742	25	read	String	3. record in alarm list (# 1)
46744 – 46768	6743 – 6767	25	read	String	4. record in alarm list (# 1)
46769 – 46793	6768 – 6792	25	read	String	5. record in alarm list (# 1)
46794 – 46818	6793 – 6817	25	read	String	6. record in alarm list (# 1)
46819 – 46843	6818 – 6842	25	read	String	7. record in alarm list (# 1)
46844 – 46868	6843 – 6867	25	read	String	8. record in alarm list (# 1)
46869 – 46893	6868 – 6892	25	read	String	9. record in alarm list (# 1)
46894 – 46918	6893 – 6917	25	read	String	10. record in alarm list (# 1)
46919 – 46943	6918 – 6942	25	read	String	11. record in alarm list (# 1)
46944 – 46968	6943 – 6967	25	read	String	12. record in alarm list (# 1)
46969 – 46993	6968 – 6992	25	read	String	13. record in alarm list (# 1)
46994 – 47018	6993 – 7017	25	read	String	14. record in alarm list (# 1)
47019 – 47043	7018 – 7042	25	read	String	15. record in alarm list (# 1)
47044 – 47068	7043 – 7067	25	read	String	16. record in alarm list (# 1)
47069 – 47168	7068 – 7167	100			Reserved (registers not implemented)

(*) in DEC

 # 1
The result of reading of an unused record is an empty string.
 # 2
The result of reading of an unused record is a domain with zero value.
 # 3
The appropriate argument must be written before writing of the command code, because immediately after the command code has been written the command is executed. For MODBUS-RTU the argument and command code can be written at once, in a multiple registers write using MODBUS function 16 (3 registers). As the argument has lower register address than command, the required

sequence is maintained. However, for MODBUS/TCP the argument and function code **must be written separately**, the argument first, then the function code. The argument must be written using MODBUS function 16 (2 registers) and then the command code using MODBUS function 6 or 16 (1 register). In MODBUS/TCP **It is not allowed to write both argument and command code as one block using function 16**. See List of commands and modbus communication examples.

 # 4
Before entering the password for writing it is necessary to define user identification number. It is recommended to enter user identification number and password simultaneously. Entered password stays valid 5 minutes after the last successful writing.
 # 5
The latest record has index 0, older record has index -1, next record has index -2, …

 # 6
It is possible to read and write only in case that history reading is not locked by another terminal. Second necessary condition is to previously write the index.
 # 7
Implicitly = 0.
#8
„Values multipacket" contains values that are currently configured in the history record.

Access to password protected objects

Dedicated communication objects are setpoints and commands that are protected by a password against writing. The set of protected objects is given in the controller configuration and is fixed for a particular controller.

In IG/IS-NT controllers it is possible to specify access levels to protected objects for 8 different users. For each user a set of access attributes is defined and each of them has his password. The user can gain the right for writing to 8 groups of objects with different access levels by entering his password. The objects are assigned into groups in the controller configuration. For example setpoints in the ProcessControl group can be configured in GenConfig on Setpoints card:

Groups	Name	Access Group								Value
ProcessControl	Base load	0 OFF	1 OFF	2 ON	3 OFF	4 OFF	5 OFF	6 OFF	7 OFF	
Basic settings	Base PF	0 OFF	1 OFF	2 ON	3 OFF	4 OFF	5 OFF	6 OFF	7 OFF	
Engine params	Import load	0 OFF	1 OFF	2 ON	3 OFF	4 OFF	5 OFF	6 OFF	7 OFF	
Engine protect	Import PF	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
Analog protect	Load ctrl PtM	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
Gener protect	PF ctrl PtM	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
Mains protect	I/E-Pm meas	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
AMF settings	I/E-Qm meas	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
Sync/Load ctrl	PeakLevelStart	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
Volt/PF ctrl	PeakLevelStop	0 OFF	1 OFF	2 OFF	3 ON	4 OFF	5 OFF	6 OFF	7 OFF	
Force value	PeakAutS/S del	0 OFF	1 OFF	2 OFF	3 OFF	4 ON	5 OFF	6 OFF	7 OFF	
Load shedding	Export limit	0 OFF	1 OFF	2 OFF	3 OFF	4 ON	5 OFF	6 OFF	7 OFF	
Act. calls/SMS	Island enable	0 OFF	1 OFF	2 OFF	3 OFF	4 OFF	5 OFF	6 OFF	7 ON	
Date/Time	ParallelEnable								7	

Tabs: Modules | I/O | Setpoints | Commands | Protections | History | User Sensors | Languages | Translator

Each user has his identification number (0 – 7). User with identification number 0 has an exceptional position. This user has access to all groups of protected objects (this access cannot be changed anyhow) and can define groups of access attributes to other users (1 – 7), reset their password and set their name (alias of an identification number). Entering of password must be foregone by writing of a user identification number.

Commands for IGS-NT

First it is necessary to enter an appropriate user and his password first to enable commands, if these are protected by level 1-7

Command (*)	Meaning	Argument (*)	Return value (*)	
1	Engine start	01FE0000	000001FF	OK
			2	Argument has not been written
	Engine stop	02FD0000	000002FE	OK
			2	Argument has not been written
	Horn reset	04FB0000	000004FC	OK
	Fault reset	08F70000	000008F8	OK
	ECU Fault reset	10EF0000	000010F0	OK
		other	1	Wrong argument
2	Close/open generator circuit breaker (IGS-NT) Clutch ON/OFF (ID)	11EE0000	000011EF	OK
			2	Argument has not been written
	Close generator circuit breaker	11EF0000	000011F0	OK
			2	Argument has not been written
	Open generator circuit breaker	11F00000	000011F1	OK
			2	Argument has not been written
	Close/open mains circuit breaker	12ED0000	000012EE	OK
			2	Argument has not been written
	Close mains circuit breaker	12EE0000	000012EF	OK
			2	Argument has not been written
	Open mains circuit breaker	12EF0000	000012F0	OK
			2	Argument has not been written
		other	1	Wrong argument
5	Reset from Init state (#1)	44440000	00004445	OK
			1	Not possible to perform
7	Statistics reset	007C0000	0000007D	OK
			1	Not possible to perform
8	Set kWh counter	New value	N/A	
C	Set kVAhr counter	New value	N/A	
D	Set counter of engine starts	New value	N/A	
E	Set runhours counter	New value	N/A	
19	Set counter of unsuccessful engine starts	New value	N/A	
1A	Set binary output RemoteSwitch1-8 (RemoteControl1-8)	00200000	N/A	
	Reset binary output RemoteSwitch1-8 (RemoteControl1-8)	00100000	N/A	
1F,20,21,22	Set pulse counters (IS-NT only)	XXXXYYYY (XXXX –	Upper value + 1	OK

		Upper part of a new value; YYYY – Lower part of a new value)	1, 2	Not possible to perform
23,24,25,26	Set ExtValue1-4 (#2)	0002YYYY (YYYY - new value)	3	OK
			1, 2	Not possible to perform

(*) in HEX

 # 8
If the controller setpoints are not valid after it is switched on, the controller goes to a blocked state. In this state it is necessary to modify the setpoints from the controller keypad and switch off and on the controller or from the external terminal and unblock the controller by **Reset from Init state** command. Another condition necessary to unblock the application function of the controller is valid configuration.
 # 2
Check if the setpoints ExtValueXLoLim and ExtValueXHiLim allow set the requested value to ExtValue.

Commands for IM-NT

First it is necessary to enter an appropriate user and his password first to enable commands, if these are protected by level 1-7

Command	Meaning	Argument (*)	Return value (*)	
1	Start command	01FE0000	000001FF	OK
			2	Argument has not been written
	Stop command	02FD0000	000002FE	OK
			2	Argument has not been written
	Horn reset	04FB0000	000004FC	OK
	Fault reset	08F70000	000008F8	OK
		other	1	Wrong argument
2	Close/open MGCB	11EE0000	000011EF	OK
			2	Argument has not been written
	Close MGCB	11EF0000	000011F0	OK
			2	Argument has not been written
	Open MGCB	11F00000	000011F1	OK
			2	Argument has not been written
	Close/open MCB / BTB	12ED0000	000012EE	OK
			2	Argument has not been written
	Close MCB / BTB	12EE0000	000012EF	OK
			2	Argument has not been written
	Open MCB / BTB	12EF0000	000012F0	OK
			2	Argument has not been written
		other	1	Wrong argument
5	Reset from Init state (#1)	44440000	00004445	OK
			1	Not possible to perform
8	Set kWh counter	New value	N/A	
C	Set kVAhr counter	New value	N/A	
1A	Set binary output RemoteSwitch1-8 (RemoteControl1-8)	00200000	N/A	

	Reset binary output RemoteSwitch1-8 (RemoteControl1-8)	00100000	N/A	
23,24,25,26	Set ExtValue1-4 (#2)	0002YYYY (YYYY - new value)	3	OK
			1, 2	Not possible to perform

(*) in HEX

 # 9
If the controller setpoints are not valid after it is switched on, the controller goes to a blocked state. In this state it is necessary to modify the setpoints from the controller keypad and switch off and on the controller or from the external terminal and unblock the controller by **Reset from Init state** command. Another condition necessary to unblock the application function of the controller is valid configuration.
 # 2
Check if the setpoints ExtValueXLoLim and ExtValueXHiLim allow set the requested value to ExtValue.

User Modbus

This function is available to BaseBox controller with standard FW v 3.0 and higher.

User Modbus function allows users to assign up to 127 registers from range 42873 to 43000 to any value or setpoint available for Modbus reading or writing in the controller. This can be used for standardizing the Modbus communication or for quick batch reading or writing (note that it is possible to write no more than 16 registers in on multiple writing request).

It is not possible to read or write both standard registers and User Modbus registers in one request (e.g. batch reading of registers 42998 to 43007 is not possible). It is perfectly fine to separate the request and read User Modbus registers and standard registers individually.

User Modbus registers are assigned in the GenConfig as a standard part of configuration. See the figure below for more information on how to assign a register. Assigned registers can be written and read the same way as standard registers (refer to the chapter above).
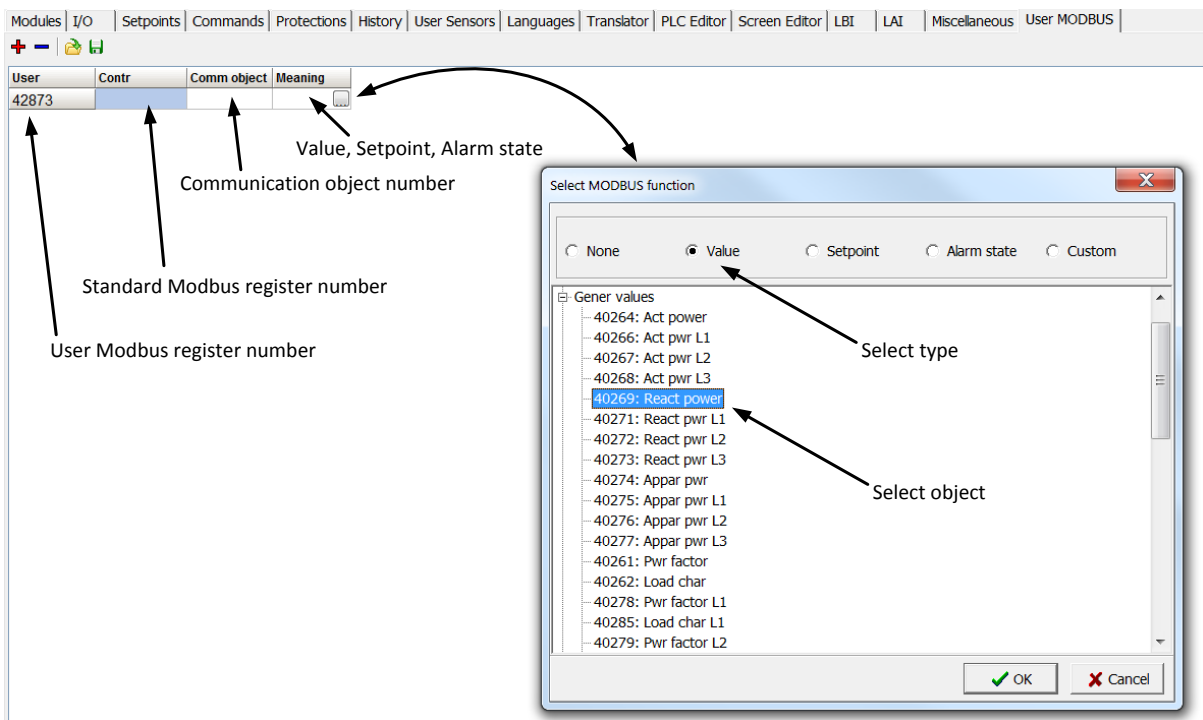
It is still possible to read the assigned object on its original register address if required.

Modbus Appendix

Modbus Switches

The "Modbus Switches" are two Modbus registers dedicated for continuous writing of binary information via Modbus. Both registers are available on Modbus for simple writing (using command 6 or 16). The particular bits of these registers are available as binary status for universal use in logical binary outputs of the controller as "MODBUSSW1..MODBUSSW32". No password is required for writing of those registers (if there is no general password for Modbus writing). There are two Values "ModbusSw1" and "ModbusSw2" in group "Log Bout" available for back-reading.

Register for writing	Modbus register number	Value for back-reading	Modbus register number
ModbusSw1	46337	ModbusSw1	40547
ModbusSw2	46338	ModbusSw2	40548

NOTE:
The LSB of ModbusSw1 (46337) corresponds with LBO "ModbusSw1"
The LSB of ModbusSw2 (46338) corresponds with LBO "ModbusSw17"

Examples:

Register port for writing	Input value	LBO ModbusSw16 ....ModbusSw1
ModbusSw1 (46337)	000F HEX	0000 0000 0000 1111

Register port for writing	Input value	LBO ModbusSw32 ....ModbusSw17
ModbusSw2 (46338)	F000 HEX	1111 0000 0000 0000

Data types

The following table contains the communication objects data types and their representation in the data part of the communication function.

Data type	Meaning	Number of registers	Data part of the communication function[1]
Integer8	Signed integer – 8 bits	1	MSB1 = sign extension LSB1 LSB1 = comm. object value
Unsigned8	Unsigned integer – 8 bits	1	MSB1 = 0 LSB1 = comm. object value
Integer16	Signed integer – 16 bits	1	MSB1 = comm. object value, bits 15-8 LSB1 = comm. object value, bits 7-0
Unsigned16	Unsigned integer – 16 bits	1	MSB1 = comm. object value, bits 15-8 LSB1 = comm. object value, bits 7-0

---

[1] MSBx = register x, bits 15-8
LSBx = register x, bits 7-0

Integer32	Signed integer – 32 bits	2	MSB1 = comm. object value, bits 31-24 LSB1 = comm. object value, bits 23-16 MSB2 = comm. object value, bits 15-8 LSB2 = comm. object value, bits 7-0
Unsigned32	Unsigned integer – 32 bits	2	MSB1 = comm. object value, bits 31-24 LSB1 = comm. object value, bits 23-16 MSB2 = comm. object value, bits 15-8 LSB2 = comm. object value, bits 7-0
Binary8	Binary number – 8 bits	1	MSB1 = 0 LSB1 = comm. object value
Binary16	Binary number – 16 bits	1	MSB1 = comm. object value, bits 15-8 LSB1 = comm. object value, bits 7-0
Binary32	Binary number – 32 bits	2	MSB1 = comm. object value, bits 31-24 LSB1 = comm. object value, bits 23-16 MSB2 = comm. object value, bits 15-8 LSB2 = comm. object value, bits 7-0
Char	ASCII character	1	MSB1 = 0 LSB1 = comm. object value
List	String list	1	MSB1 = 0 LSB1 = comm. object value
ShortStr	ASCII string of max. length of 15 characters (zero terminated string)	8	MSB1 = 1. character of the string LSB1 = 2. character of the string MSB2 = 3. character of the string LSB2 = 4. character of the string …
LongStr	ASCII string of max. length of 31 characters (zero terminated string)	16	MSB1 = 1. character of the string LSB1 = 2. character of the string MSB2 = 3. character of the string LSB2 = 4. character of the string …
Date	Date	2	MSB1 = BCD(day) LSB1 = BCD(month) MSB2 = BCD(year) LSB2 = 0 example: MSB1 = 18 (HEX) LSB1 = 04 (HEX) MSB2 = 01 (HEX) LSB2 = 0 ⇒ Date = 18.4.(20)01
Time	Time	2	MSB1 = BCD(hour) LSB1 = BCD(minute) MSB2 = BCD(second) LSB2 = 0 example: MSB1 = 20 (HEX) LSB1 = 24 (HEX) MSB2 = 02 (HEX) LSB2 = 0 ⇒ Time = 20:24:02

Domain	Field n bytes C-declaratione: unsigned char x[n]	n	MSB1 = x[0] LSB1 = x[1] MSB2 = x[2] LSB2 = x[3] … n is even number: MSBm-1 = x[n-2] LSBm = x[n-1] n is odd number: MSBm-1 = x[n-1] LSBm = 0
String	String (Zero terminated string)	depends on register number	string characters coding depends on chosen language (8bit coding, EUC)

Communication status

Communication object number:
24571
Operation:
Read only
Data type:
Binary32
Meaning:

Bit 0	Internal terminal in InteliSys does not work (0 for other controllers)
Bit 1	Invalid controller software (based on CRC).
Bit 2	Invalid controller configuration (based on CRC).
Bit 3	In the event history is present at least one unread record.
Bit 4	P type setpoints are invalid.
	P type setpoints are representing the controller setpoints. Values of these setpoints can be set from connected terminals. If these setpoints are invalid, the application functions are blocked. Setpoints recovery is needed.
Bit 5	R type setpoints are invalid.
	R type setpoints are representing the data, that is only initialized from connected terminals, but its updating is made by the controller itself (e.g. statistic or time and date). If these setpoints are invalid, their change from the controller is blocked. Setpoints recovery is needed.
Bit 6	The event history was cleared.
Bit 7	The event history was filled up at least once.
Bit 8	P type setpoint change occurred (reading resets this bit).
Bit 9	R type setpoint change occurred (reading resets this bit).
Bit 10	Controller type – see the table below.
Bit 11	Alarm list not empty.
Bit 12	Alarm list change (reading resets this bit).
Bit 13	New item added into alarm list (reading resets this bit).
Bit 14	Internal controller terminal is locked up for setpoint change.
Bit 15	Invalid configuration format.
Bit 16	Diagnostic codes change (reading resets this bit, only for IL-NT /ID controllers).
Bits 20	Controller type (*)
Bit 21-17	Reserve (= 0)
Bits 22-21	Password level for Setpoints and Commands write (only for IL-NT /ID controllers).
Bit 23	Controller was initiated.
Bits 28-24	Communication module version.
Bits 29	Remote terminal is connected.
Bits 30	Controller type – see the table below.
Bits 31	Reserve (= 0)

(*) Controller type

Bit 20	Bit 30	Bit 10	Controller
0	0	0	InteliSys
0	0	1	InteliGen
0	1	0	IL-NT
0	1	1	InteliDrive
1	0	0	IG/IS-NT
1	0	1	Reserve
1	1	0	Reserve
1	1	1	Reserve

Hint:

The MODE< and MODE> commands have not been implemented to the register oriented modbus commands.

Error list

If the controller encounters an error when processing the query, it returns the exceptional response instead of the normal one to the terminal. An exception has always the value 2 (*Illegal Data Address*). After receiving the exceptional response, the terminal should read the communication object 24523 containing the last error specification. The meaning of an error can be found out from the following table.

MSB1 (*)	LSB1 (*)	MSB2 (*)	LSB2 (*)	Meaning
0	0	0	0	No error.
0	0	2	6	Comm. Object nonexistent.
0	0	1	6	Illegal access: Read (write) of the communication object. Object intended only for write (read).
255	0	0	8	Controller application isn't active
254	0	0	8	Inexpectant message
253	0	0	8	No more unread records in event history.
252	0	0	8	Setpoint not defined in controller configuration.
251	0	0	8	Bad write data length.
250	0	0	8	Invalid password.
249	0	0	8	No more free space in front for EEPROM
248	0	0	8	Too long parameter
247	0	0	8	Invalid controller configuration.
246	0	0	8	Undefined command
245	0	0	8	Command can't be done
244	0	0	8	Too long data answer form peripheries (max. 4B)
243	0	0	8	Too long data for peripheries (max. 4B)
242	0	0	8	Unavailable peripheries
241	0	0	8	Required operation isn't available in peripheries
240	0	0	8	Operation cannot be performed now, the terminal has to repeat the request. This error can occur when an operation with EEPROM memory (setpoint write, history record read) is required at the same time while an internal EEPROM write cycle takes place.
239	0	0	8	Controller programming can't be carry out

MSB1 (*)	LSB1 (*)	MSB2 (*)	LSB2 (*)	Meaning
238	0	0	8	Write cannot be performed – power supply failure detected.
237	0	0	8	Another active call request is present. This error code can be returned by the controller as the response to the communication object. Object 24540 write – active call termination.
236	0	0	8	Programming error
235	0	0	8	This error is reported by iG-MU module (*Modem Bridge*) in the case of a connection failure between the module and the addressed controller. The terminal can evaluate this error as a communication *timeout* with the controller.
234	0	0	8	Write cannot be performed – periphery not responding.
233	0	0	8	Write cannot be performed – setpoint nonexistent in any periphery.
232	0	0	8	Bad access code for communication from a remote terminal.
231	0	0	8	Invalid controller address: value out of range 1 to 32 or already used. This error is a reaction on communication object. Object 24537 write.
230	0	0	8	Error in definition for communication oscilloscope objects
229	0	0	8	Undefined action. A reaction on communication object. Object 24521 write.
228	0	0	8	Action (although defined) cannot be performed. A reaction on communication object. Object 24521 write.
227	0	0	8	Written object value is not acceptable.
226	0	0	8	No more free slots
225	0	0	8	No connection
224	0	0	8	Locked, block reading is active
223	0	0	8	Locked, commanding is active
222	0	0	8	Locked, the history reading is active
221	0	0	8	Locked, the programming is active
220	0	0	8	Communication error
219	0	0	8	Request for – data
218	0	0	8	Request for – SMS
217	0	0	8	Request for – email
216	0	0	8	Request for – mobile email
215	0	0	8	Request for - fax
214	0	0	8	Wrong access code, the connection must be terminated.
213	0	0	8	Reserved for HW key
212	0	0	8	Reserved for DENOX
211	0	0	8	Unsufficient access rights.
210	0	0	8	The request can be submitted only by the administrator (User 0).
209	0	0	8	The administrator has entered a wrong user identification number.
208	0	0	8	Not possible to write, the communication object has forced value.
207	0	0	8	The administrator requests an unsupported operation.
206	0	0	8	Selected communication mode doesn't allow required interface
205	0	0	8	Selected interface doesn't allow required communication mode
204	0	0	8	HW data flow control for modem communication. Sending as answer to request to read 24437 communication object
203	0	0	8	SW data flow control for modem communication. Sending as answer to request to read 24437 communication object
202	0	0	8	Access denied from actual IP address
201	0	0	8	Unknown fault.
200	0	0	8	Invalid register.
199	0	0	8	Reading of alarm list is locked.
198	0	0	8	Reading of history is locked.
197	0	0	8	Reading of alarm list has to be started by reading the first record.
196	0	0	8	The history record is not defined for reading of history.
195	0	0	8	It is not possible to request such number of registers.
201	0	0	8	Unknown fault.
200	0	0	8	Invalid register.

MSB1 (*)	LSB1 (*)	MSB2 (*)	LSB2 (*)	Meaning
199	0	0	8	Reading of alarm list is locked.
198	0	0	8	Reading of history is locked.

(*) in DEC   dedicated for Internet
Bridge

Note:
ComAp believes that all information provided herein is correct and reliable and reserves the right to update at any time. ComAp does not assume any responsibility for its use unless otherwise expressly undertaken.

Examples of Modbus Communication

In this chapter are some examples, how does communicate controller via Modbus.

Battery voltage – reading (read multiple registers)

Request: **01 03 00 0C 00 01** 44 09

01	= Controller address
	– see your controller settings
03	= Modbus function code (Read Multiple Registers)
00 0C	= Register address: Register number (Ubat => 40013)
	– 40013 - 40001 = 12 DEC => 000C HEX
	– see your Cfg Image or list of dedicated communication objects

A part of Cfg Image (Modbus Register …)

Register(s)	Com.Obj.	Name	Dim	Type	Len	Dec	Min	Max	Group
40012	8239	BOUT		Binary#2	2	-	-	-	Bin outputs CU
40013	8213	Ubat	V	Integer	2	1	0	360	Analog CU
40014	10124	CPU temp	°C	Integer	2	1	-200	800	Analog CU
40015	10603	Dplus	V	Integer	2	1	0	360	Analog CU
40016	0155				2	1			

00 01	= Number of registers
	– 40013, it is one register = 01 DEC => 0001 HEX
	– you have to calculate number of register which you want read
09 44	= CRC
	–CRC has to be written LSB then MSB ! See how to calculate CRC. or implementation in C language – page 117.

Response: **01 03 02 00 DC** B9 DD

01	= Controller address
	– see your controller settings
03	= Modbus function code (Read Multiple Registers)
02	= Length of read data in Bytes (in HEX)
	– 02 HEX => 2 DEC
	– define the length of data
00 DC	= Value of battery voltage
	– DC HEX => 220 DEC => Batt. voltage is represented with 1 decimal => 22,0 VDC
	– convert the data from hex to dec. Use the multiplication factor (In this case 0.1) !
DD B9	= CRC
	– check with your CRC, because of data validity

A part of Cfg Image (Modbus Register …)

Register(s)	Com.Obj.	Name	Dim	Type	Len	Dec	Min	Max	Group
40012	8239	BOUT		Binary#2	2	-	-	-	Bin outputs CU
40013	8213	Ubat	V	Integer	2	1	0	360	Analog CU
40014	10124	CPU temp	°C	Integer	2	1	-200	800	Analog CU
40015	10603	Dplus	V	Integer	2	1	0	360	Analog CU
40016	0155				2	1			

Values (Oil press, Water temp, Fuel level) – reading

Request: **01 03 00 0F 00 03 35 C8**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
00 0F	= Register address: Register number (40016) – 40001 = 15 DEC => 0F HEX
00 03	= Number of registers (40016 – Oil press, 40017 – Water temp, 40018 – Fuel level) = 3 DEC = > 03 HEX
C8 35	= CRC (write LSB MSB !)

```
        A part of Cfg Image (Modbus Register …)

Register(s)    Com.Obj. Name          Dim  Type      Len Dec   Min    Max Group

  40015         10603   Dplus          V    Integer    2   1     0     360 Analog CU
  40016          9155   Oil press      Bar  Integer    2   1     0     100 Analog CU
  40017          9156   Water temp     °C   Integer    2   0     0     150 Analog CU
  40018          9157   Fuel level     %    Integer    2   0     0     100 Analog CU
```

Response: **01 03 06 00 27 00 2E 00 2B 35 64**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
06	= Length of read data in Bytes (in HEX)
00 27	= 27 HEX => 39 DEC => 3,9 Bar (Oil pressure is represented with 1 decimal in Bars)
00 2E	= 2E HEX => 46 DEC => 46°C (Water temperature is represented with 0 decimals in °C)
00 2B	= 2B HEX => 43 DEC => 43% (Fuel level is represented with 0 decimals in %)
64 35	= CRC

Binary input - reading

Request: **01 03 00 02 00 01 25 CA**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
00 02	= Register address: Register number (40003) – 40001 = 02 DEC => 02 HEX
00 01	= Number of registers (40003) = 01 DEC => 01 HEX
CA 25	= CRC (write LSB MSB !)

Response: **01 03 02 00 0A 38 43**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
02	= Length of read data in Bytes (in HEX)
00 0A	= Object data value (Binary input = 0000000000001010 i.e. BI2 and BI4 are set)*
43 38	= CRC

* Table of binary inputs (BI)

BI16	BI15	BI14	BI13	BI12	BI11	BI10	BI9	BI8	BI7	BI6	BI5	BI4	BI3	BI2	BI1
		0				0				0				A	
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0

Password decode - reading

Request: **01 03 00 A0 00 02 C4 29**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
00 A0	= Register address: Register number (40161) – 40001 = 160 DEC => A0 HEX
00 02	= Number of registers (40161 and 40162) = 02 DEC => 02 HEX
29 C4	= CRC (write LSB MSB !)

Response: **01 03 04 68 73 90 00 7B 88**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
04	= Length of read data in Bytes (in HEX)
68 73 90 00	= 68739000 HEX => 1752403968 DEC = > password decode is **1752403968**
88 7B	= CRC

Gen-set name - reading

Request: **01 03 0B B8 00 08 C6 0D**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
0B B8	= Register address: Register number (43001) – 40001 = 3000 DEC => BB8 HEX
00 08	= Number of registers (43001 - 43008) = 08 DEC => 08 HEX
0D C6	= CRC (write LSB MSB !)

Response: **01 03 10 49 47 53 2D 4E 54 00 00 00 00 00 00 00 00 00 00 D7 6A**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
10	= Length of read data in Bytes (in HEX)
49 47	= Object data value (IG)
53 2D	= Object data value (S-)
4E 54	= Object data value (NT)
00 00	= Object data value (_ _)
00 00	= Object data value (_ _)
00 00	= Object data value (_ _)
00 00	= Object data value (_ _)
00 00	= Object data value (_ _) =.> gen-set name is **IGS-NT**
6A D7	= CRC

Engine state - reading

Request: **01 03 00 A2 00 01 25 E8**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
00 A2	= Register address: Register number (40163) – 40001 = 162 DEC => A2 HEX
00 01	= Number of registers (40163)
E8 25	= CRC (write LSB MSB !)

Response: **01 03 02 00 02 39 85**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
02	= Length of read data in Bytes (in HEX)
00 02	= Object data value – see the List#1 in the Cfg Image => **(NotReady)**
85 39	= CRC

A part of Cfg Image (Modbus Register …)

```
Register(s)   Com.Obj. Name          Dim  Type      Len Dec   Min    Max Group
40001         8505     (N/A)
40163         9244     Engine State       List#1          -    429    449 Info
43025         8252     Gear teeth         Unsigned   2    0      0    500 Basic settings
43026         8253     Nominal RPM    RPM Unsigned   2    0    100   4000 Basic settings
43027         8315     ControllerMode     List#3     1    -    359    363 Basic settings
```



```
        A part of Cfg Image (Modbus Register …)
----------------------------------------
List#1

Value  Name
----------------------------------------
    0  Init
    1  Ready
    2  NotReady
    3  Prestart
    4  Cranking
    5  Pause
```

Gear teeth – writing

Request: **01 06 0B D0 00 7D 4A 36**

01	= Controller address
06	= Modbus function code (Write Single Register)
0B D0	= Register address: Register number (43025) – 40001 = 3024 DEC => BD0 HEX
00 7D	= Gear teeth > 125 DEC => 7D HEX
36 4A	= CRC (write LSB MSB !)

Response: **01 06 0B D0 00 7D 4A 36**

01	= Controller address
06	= Modbus function code (Write Single Register)
0B D0	= Register addres
00 7D	= Set the setpoint gear teeth to > 7D HEC => 125 DEC = **125**
36 A4	= CRC

Nominal Power – writing

Request: **01 06 0B C0 01 F4 8B C5**

01	= Controller address
06	= Modbus function code (Write Single Register)
0B C0	= Register address: Register number (43009) – 40001 = 3008 DEC => BC0 HEX
01 F4	= Nominal power > 500 DEC => 1F4 HEC
C5 8B	= CRC (write LSB MSB !)

Response: **01 06 0B C0 01 F4 8B C5**

01	= Controller address
06	= Modbus function code (Write Single Register)
0B C0	= Register addres
01 F4	= Set the setpoint nominal power to > 1F4 HEC => 500 DEC = **500**
C5 8B	= CRC

Mode – writing

Request: **01 06 0B D2 00 03 6B D6**

01	= Controller address
06	= Modbus function code (Write Single Register)

0B D2	= Register address: Register number (43027) – 40001 = 3026 DEC => BD2 HEX
00 03	= Set the controller mode to > TEST **=>** 03 **–** see the List#3 in the Cfg Image
D6 6B	= CRC (write LSB MSB !)

```
        A part of Cfg Image (Modbus Register …)
List#3

Value  Name
-----------------------
    0  OFF
    1  MAN
    2  AUT
    3  TEST
```
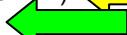
Response: **01 06 0B D2 00 03 6B D6**

01	= Controller address
06	= Modbus function code (Write Single Register)
0B D2	= Register addres
00 03	= Object data value > **TEST**
D6 6B	= CRC

Reset / Confirm Alarm

Request: **01 10 18 D6 00 03 06 08 F7 00 00 00 01 49 CB**

01	= controller address
10	= Modbus command
18 D6	= Register address: Object for engine commands (46359) – 40001 = 6358 DEC => 18D6 HEX
00 03	= number of Modbus registers
06	= data length in bytes (08F70000+0001)
08F70000	= argument for **Fault reset** (page 121)
0001	= command number (page 121)
CB 49	= CRC (write LSB MSB !)

```
    A part of dedicated communication objects table
```

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46359 – 46360	6358 – 6359	2	read/write	Unsigned32	For writing:command argument For reading: command release value (# 3)
46361	6360	1	write	Unsigned16	Command (# 3)

```
    A part of list of commands
```

Command	Meaning	Argument (*)	Return value (*)	
			000001FF	OK
	Engine start	01FE0000	2	Argument has not been written
	Engine stop	000002FE	OK	
1		02FD0000	2	Argument has not been written
	Horn reset	4FB0000	000004FC	OK
	Fault reset	08F70000	000008F8	OK
	ECU Fault reset	10EF0000	000010F0	OK
		other	1	Wrong argument

Response: **01,10,18,D6,00,03,67,50**

01	= Controller address
10	= Modbus command

18 D6	= Register addres
00 03	= Release value, number of written Modbus registers
50 67	= CRC

Remote Switch 1 – Set (Remote Control 1)

Request: **01 10 18 D6 00 03 06 00 20 00 00 00 1A 7C 9A**
01	= controller address
10	= Modbus command
18 D6	= Register address: Object for engine commands (46359) – 40001 = 6358 DEC
	=> 18D6 HEX
00 03	= number of Modbus registers
06	= data length in bytes (08F70000+001A)
00200000	= argument for **RemoteSwitch1-8** (page 121)
001A	= command number (page 121), command = 26 DEC = 001A HEX
9A 7C	= CRC (write LSB MSB !)

Response: **01 10 18 D6 00 03 67 50**
01	= Controller address
10	= Modbus command
18 D6	= Register addres
00 03	= Release value, number of written Modbus registers
50 67	= CRC

Request: **01 10 18 D6 00 03 06 00 10 00 00 00 1A 3C E9 –** Remote Switch 1 – Off
Request: **01 10 18 D6 00 03 06 00 20 00 01 00 1A 8C 9A** – Remote Switch 2 – Set

Table of arguments

RemoteSwitch	1	2	3	4	5	6	7	8
Set / On	00200000	00200001	00200002	00200003	00200004	00200005	00200006	00200007
Off	00100000	00100001	00100002	00100003	00100004	00100005	00100006	00100007

External Value1 – writing

Request: **01 10 18 D6 00 03 06 00 02 00 24 00 23 04 84**
01	= controller address
10	= Modbus command
18 D6	= Register address: Object for engine commands (46359) – 40001 = 6358 DEC
	=> 18D6 HEX
00 03	= number of Modbus registers
06	= data length in bytes (00020024+0023)
00020024	= argument for **Set ExtValue 1-4** (page 121) (value 36DEC = 0024HEX)
0023	= command number (page 121), command = 35 DEC = 0023 HEX
84 04	= CRC (write LSB MSB !)

Response: **01 10 18 D6 00 03 67 50**
01	= Controller address
10	= Modbus command
18 D6	= Register addres
00 03	= Release value, number of written Modbus registers
50 67	= CRC

User & Password – in two steps

Request: **01 06 18 DA 00 00 AE 91**

01	= controller address
06	= Modbus function code (Write Single Register)
18 DA	= Register address: Object for user identification (46363) – 40001 = 6362 DEC
	=> 18DA HEX
00 00	= ID of user; Administrator = 00 => 0000
91 AE	= CRC (write LSB MSB !)

```
A part of dedicated communication objects table
```

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46361	6360	1	write	Unsigned16	Command (# 3)
46362	6361	1			Reserved (register not implemented)
46363	6362	1	read/write	Unsigned8	User identification number (# 4)
46364	6363	1	write	Unsigned16	Entering of password for writing (# 4)
46365	6364	1			Reserved (register not implemented)
46366 – 46490	6365 – 6489	125	read	Domain	Values multipacket(#8)

Response: **01 06 18 DA 00 00 AE 91**

01	= Controller address
06	= Modbus command
18 DA	= Register addres
00 00	= Release value
91 AE	= CRC

Request: **01 06 18 DB 00 00 FF 51**

01	= controller address
06	= Modbus function code (Write Single Register)
18 DB	= Register address: Object for entering password (46364) – 40001 = 6363 DEC
	=> 18DB HEX
00 00	= Password = 00 => 0000
51 FF	= CRC (write LSB MSB !)

Response: **01 06 18 DB 00 00 FF 51**

01	= Controller address
06	= Modbus command
18 DB	= Register addres
00 00	= Release value
51 FF	= CRC

Hint:

Before entering the password for writing it is necessary to define user identification number. It is recommended to enter user identification number and password simultaneously. Entered password stays valid 5 minutes after the last successful writing.

User & Password – in one step

Request: **01 10 18 DA 00 02 04 00 00 00 00 D4 8C**

01	= controller address
10	= Modbus command (Write Multiple Register)
18 DA	= Register address: Object (46363) – 40001 = 6362 DEC => 18DA HEX
00 02	= number of Modbus registers (user & password)
04	= data length in bytes (00 00 00 00)
00 00 00 00	= User identification "00 00" & password "00 00"
8C D4	= CRC (write LSB MSB !)

A part of dedicated communication objects table

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46361	6360	1	write	Unsigned16	Command (# 3)
46362	6361	1			Reserved (register not implemented)
46363	6362	1	read/write	Unsigned8	User identification number (# 4)
46364	6363	1	write	Unsigned16	Entering of password for writing (# 4)
46365	6364	1			Reserved (register not implemented)
46366 – 46490	6365 – 6489	125	read	Domain	Values multipacket(#8)

Response: **01,10,18,DA,00,02,66,93**

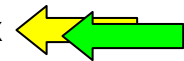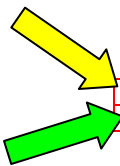|	
01	= Controller address
10	= Modbus command
18 DA	= Register addres
00 02	= number of written Modbus registers
93 66	= CRC

Start the engine – in one step

To start the engine it is necessary to enter an appropriate user and his password first to enable commands, if these are protected by level 1-7.

Request: **01 10 18 D6 00 03 06 01 FE 00 00 00 01 95 53**

01	= controller address
10	= Modbus command (Write Multiple Register)
18D6	= 6538 object for engine commands (46359) – 40001 = 6358 DEC => 18D6 HEX
0003	= number of Modbus registers
06	= data length in bytes (01FE0000+0001)
01FE0000	= argument for **Engine start** (page 121)
0001	= command number (page 121)
53 95	= CRC (write LSB MSB !)

Response: **01 10 18 D6 00 03 67 50**

01	= Controller address
10	= Modbus function code (Read Multiple Registers)
18 D6	= Register addres
00 03	= Release value, number of written Modbus registers
50 67	= CRC

Start the engine – in two steps

Request 1: **01 10 18 D6 00 02 04 01 FE 00 00 B4 D5**

01	= Controller address
10	= Modbus function code (Write Multiple Register)
18 D6 HEX	= Register address for command argument (46359) – 40001 = 6358 DEC => 18D6
00 02	= Number of registers
04	= Number of bytes that will be written (01FE0000)
01 FE 00 00	= command number (page 121)
D5 B4	= CRC (write LSB MSB !)

Request 2: **01 06 18 D8 00 01 CE 91**

01	= Controller address
06	= Modbus function code (Write Single Register)
18 D8	= Register address for command (46361) – 40001 = 6360 DEC => 18D8 HEX
00 01	= command number (page 121)
91 CE	= CRC

History – reading

See more information about History reading on page *116*.

Hint:
If you use the ModScan32 PC tool, use the script for this issue.

1 of 3 - first the index of history record must be entered:
Request: **01 06 18 D4 00 00 CF 52**

01	= Controller address
06	= Modbus function code (Write Single Register)
18 D4	= Register address of the history index (46357) – 40001 = 6356 DEC => 18D4 HEX
00 00	= First history record (index = 0)
52 CF	= CRC (write LSB MSB !)

Response: **01 06 18 D4 00 00 CF 52**

A part of dedicated communication objects table

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46354	6353	1	read	Unsigned8	Number of records in the alarm list
46356	6355	1			Reserved (register not implemented)
46357	6356	1	read/write	Integer16	Index of requested history record (# 5)
46493 – 46541	6492 – 6540	50	read	String	Header of the particular history record (# 1)
46543 – 46667	6542 – 6666	125	read	Domain	Data part of the particular history record (# 2)
46668	6667	1			Reserved (register not implemented)
46669 – 46693	6668 – 6692	25	read	String	1. record in alarm list (# 1)
46694 – 46718	6693 – 6717	25	read	String	2. record in alarm list (# 1)
46719 – 46743	6718 – 6742	25	read	String	3. record in alarm list (# 1)

2 of 3 - reading of history record header:
Request: **01 03 19 5C 00 32 03 51**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
19 5C HEX	= Register address of history record header (46493) [*2] – 40001 = 6492 DEC => 195C
00 32	= Number of registers > 46493 – 46541 => 50 DEC => 32 HEX
51 03	= CRC (write LSB MSB !)

Response: **01 03 64 4D 43 42 20 63 6C 6F 73 65 64 20 20 20 20 20 20 20 20 20 20 20 30 33 2F 30 39 2F 32 30 30 38 20 20 31 35 3A 34 34 3A 35 37 2E 39 00 … 00 00 0E E0**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
64	= Length of read data in Bytes (in HEX)
4D .. 39 …	= Object data value > 1.record in alarmlist is **MCB closed 03.09.2008**

15:44:57.9

E0 0E	= CRC

3 of 3 - reading of the data part of history record:
Request: **01 03 19 8E 00 7D E2 9C**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
19 8E	= Register address of history record header (46543) – 40001 = 6542 DEC => 198E

HEX

00 7D	= Number of registers > 46542 – 46667 => 125 DEC => 7D HEX
9C E2	= CRC (write LSB MSB !)

Response: **01 03 FA 00 00 00 00 00 00 00 20 00 … 00 00 F4 01 FD 00 FD 00 FD 00 00 00 00 00 00 00 00 00 64 20 00 00 00 00 64 00 D8 00 55 01 00 00 A1 00 7A 00 64 00 0A 00 18 00 00 00 00 … 00 00 20 3B**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
FA	= Length of read data in Bytes (in HEX)
00 .. 00	= Object data value > for reading this data see table 7 *History Record* in

Communication   object description (in PC tool -> File –> Generate Cfg Image –> Generate Cfg Image (Comm. Objects …))

3B 20	= CRC

AlarmList reading

See more information about

Request: **01 03 1A 0C 00 19 43 B1**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
1A 0C	= Register address: Register number (46669) – 40001 = 6668 DEC => 1A0C HEX
00 19	= Number of registers > 46669 – 46693 => 25 DEC => 19 HEX
B1 43	= CRC (write LSB MSB !)

A part of dedicated communication objects table

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46354	6353	1	read	Unsigned8	Number of records in the alarm list
46357	6356	1	read/write	Integer16	Index of requested history record (# 5)
46364	6363	1	write	Unsigned16	Entering of password for writing (# **4**)
46542	6541	1			Reserved (register not implemented)
46668	6667	1			Reserved (register not implemented)
46669 – 46693	6668 – 6692	25	read	String	1. record in alarm list (# 1)
46694 – 46718	6693 – 6717	25	read	String	2. record in alarm list (# 1)
46719 – 46743	6718 – 6742	25	read	String	3. record in alarm list (# 1)

Response: **01 03 32 2A 53 64 20 53 44 20 31 32 … 00 00 18 F5**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
32	= Length of read data in Bytes (in HEX)
2A 53	= Object data value (* S)

64 20	= Object data value (d _)
53 44	= Object data value (S D)
20 31	= Object data value (_ 1)
32 00 …	= Object data value (2) = > 1.record in alarmlist is ***Sd SD 12** (inactive, not accepted)
F5 18	= CRC

Response: **01 03 32 21 2A 53 64 20 53 44 20 31 32 00 00 … 00 00 89 38**

01	= Controller address
03	= Modbus function code (Read Multiple Registers)
32	= Length of read data in Bytes (in HEX)
21 2A	= Object data value (! *)
53 64	= Object data value (S d)
20 53	= Object data value (_ S)
44 20	= Object data value (D _)
31 32 …	= Object data value (1 2) = > 1.record in alarmlist is **!*Sd SD 12** (active, not accepted)
38 89	= CRC

Change the communication language (only String type data)

Write to the communication object 6350 the index of language to be used.

A part of dedicated communication objects table

Registers (*)	Register addresses (*)	Number of registers	Access	Data type	Meaning
46349 – 46350	6348 – 6349	2	read/write	Date	Actual date
46351	6350	1	read/write	Unsigned8	Language index selected for displaying of texts specified by data type String (# 7)
46352 – 4653	6351 – 6352	2	read	Domain	Code of the last communication fault See Error list
46354	6353	1	read	Unsigned8	Number of records in the alarm list
46349 – 46350	6348 – 6349	2	read/write	Date	Actual date
46351	6350	1	read/write	Unsigned8	Language index selected for displaying of texts specified by data type String (# 7)

Request: **01 06 18 CE 00 01 2F 55**

01	= Controller address
06	= Modbus function code (Write Single Register)
18 CE	= Register address: Register number (46351) – 40001 = 6350 DEC => 18CE HEX
00 01	= Set the language index to > 1
55 2F	= CRC (write LSB MSB !)

Response: **01 06 18 CE 00 00 EE 95**

01	= Controller address
06	= Modbus function code (Read Multiple Registers)
18 CE	= Register address
00 01	= Language index set to > **1**
55 2F	= CRC