

**Research & Development overview of**

**Bausch Datacom NV**

**Communication Products for the Industrial market**

**Bausch Datacom NV    Filip Lavaerts**

**e-mail        [filip@bausch.be](mailto:filip@bausch.be)  
telephone    +32 16 46.12.88  
mobile        +32 475 48.63.91**



## Presentation Overview

Chronological engineering milestones

Standard Rockwell technology AND Additional Bausch implementation

Proxima modem **technology**

**Modular** DinLine concept

GSM modem for the '**Industrial**' market --> GSMDM-2

InduBox **professional** housing

InduBox **GSM** design

InduBox **Socket** design

InduBox **GPRS** design

InduBox GPRS **enhanced** features + sample configurations

GPRS background

Power Supply requirements

Overview



- 1987 Bausch Datacom (NL) enters the European market.
- 1988 Introduction of an electronic home banking packet for the Postbank (NL).
- 1989 Opening of the Belgian and German sales offices.
- 1992 Introduction of a new Windows based “terminal emulation” communication packet ComPlus.
- 1993 **Start of the Belgian R&D department.**  
Development of the **MOD144** table top modem, the first ‘payable’ async/synch V.32 external modem for PSTN and leased lines.  
Start of development of the build-in **Delta modem line**.
- 1994 Development of the first V.34 PCMCIA card with internal line interface.  
Start of the **Proxima modem technology** with easy to use features ; leased line, dial back, autosync, remote control, async DTR-dialling, Dump Mode, ...  
First V.Fast modem on the Belgian market.
- 1995 Introduction of the Proxima V.34 modem line in a table top modem, internal ISA PC-card and in a 19” rack card.
- 1997 Proxima modems with K56Flex modulation, flash upgradable to V.90.  
All new modems designs meets the European CTR21 approvals.
- 1999 Start of the modular **DinLine** modem concept for the industrial market. One of the first modems with embedded TCP/IP capable of sending an e-mail after an input pin change.  
Upgrade of the **Delta** modem with V.90 and ASVD, DSVD options.
- 2000 Introduction of ‘GSM data’ modules into the DinLine concept. This modem is based on the Wavecom technology.  
Creation of small build-in modems based on the Socket and I-modem format for te European market.
- 2001 Development of the **GSMDM-2** GSM modem for the metering market. This modem is based on the Conexant GSM technology and has a 20 mA current loop interface.
- 2002 Development of a new modem housing for the industrial market.  
The **InduBox GSM** will be the first design into this housing. This GSM modem has the same modem specifications as the GSMDM-2 modem but the current loop interface is available as an option.
- 2003 Development of the **InduBox Socket** and the **InduBox GPRS** products with different power supply options and an optional RISC processor to implement I/O handling.

## Basic Rockwell / Conexant modem technology

- modem V.21 ... V.90/V.92
- FAX Class 1 / 1.0 / 2
- voice SpeakerPhone / ASVD / DSVD
- asynchronous / synchronous communication
- autosync



good for standard applications with **intelligent** terminals ...

## Additional Bausch implementations

- automatic dialling after a DTR activation
- dialback with or without password verification
- remote configuration
- leased line support
- dump mode support (no aborts during dialling)



thanks to those features the modem can be used with **non-intelligent** terminals ...

We had one big disadvantage with the existing **Proxima technology** : the hardware was fixed !

- \* power supply : 9 Vac
- \* serial Interface : RS-232
- \* WAN module : PSTN and/or leased line modem

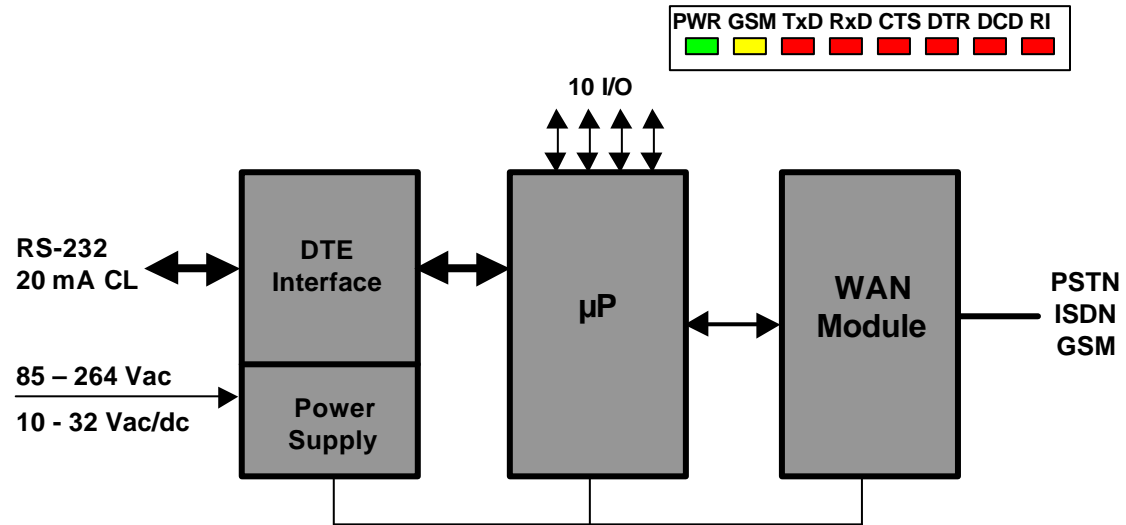


The **DinLine** concept was the answer to this disadvantage ...



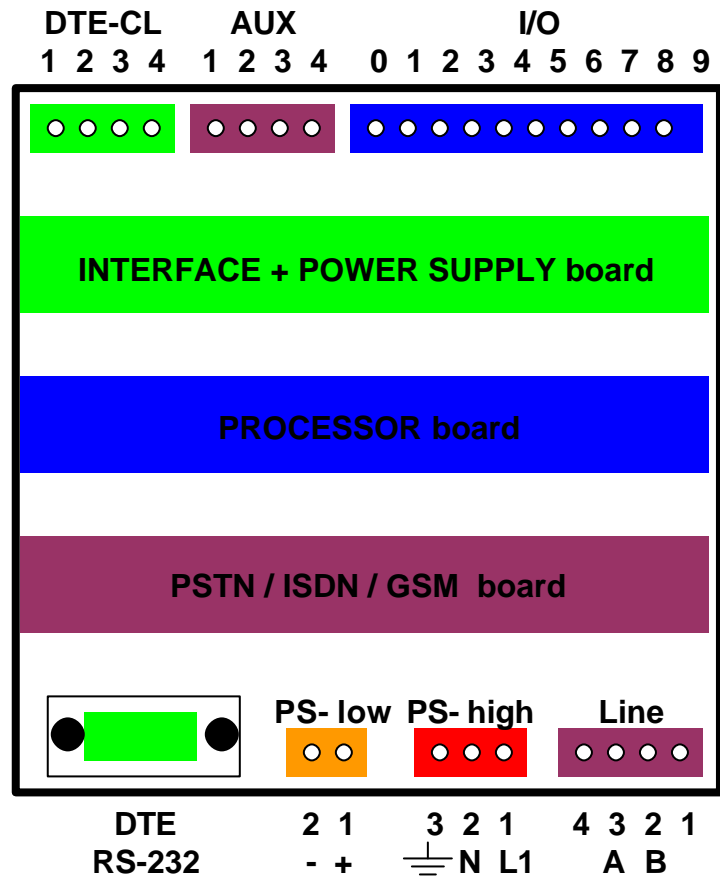
Modular DinLine concept





Modular DinLine concept





Modular DinLine concept



The **DinLine** concept was developed for PSTN and ISDN connectivity ...  
not for GSM communication modules ...

Power Supply problems  
SIM card reader  
antenna connector  
CE issues (safety)

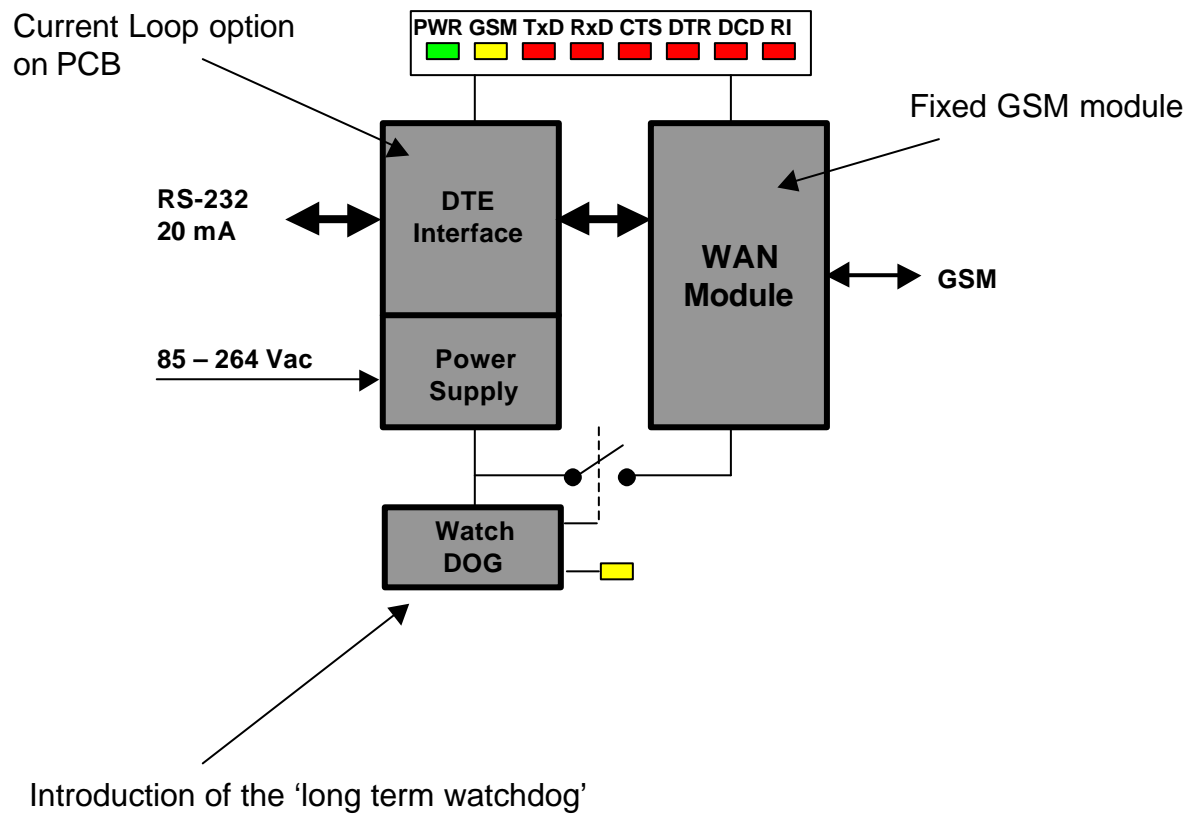
--> new design **GSMDM-2**



GSMDM-2 GSM modem

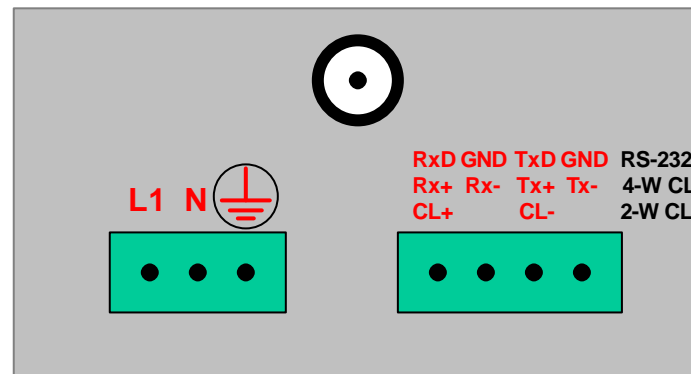
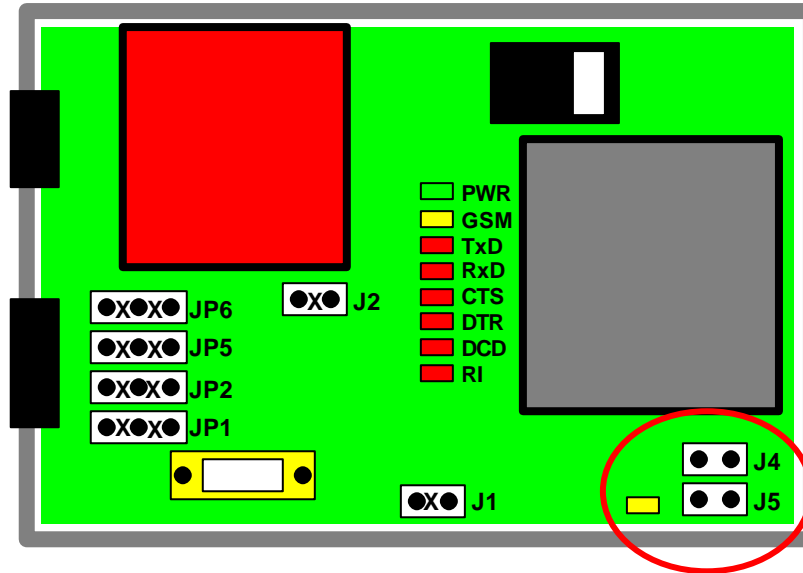
**BAUSCH**  
datacom





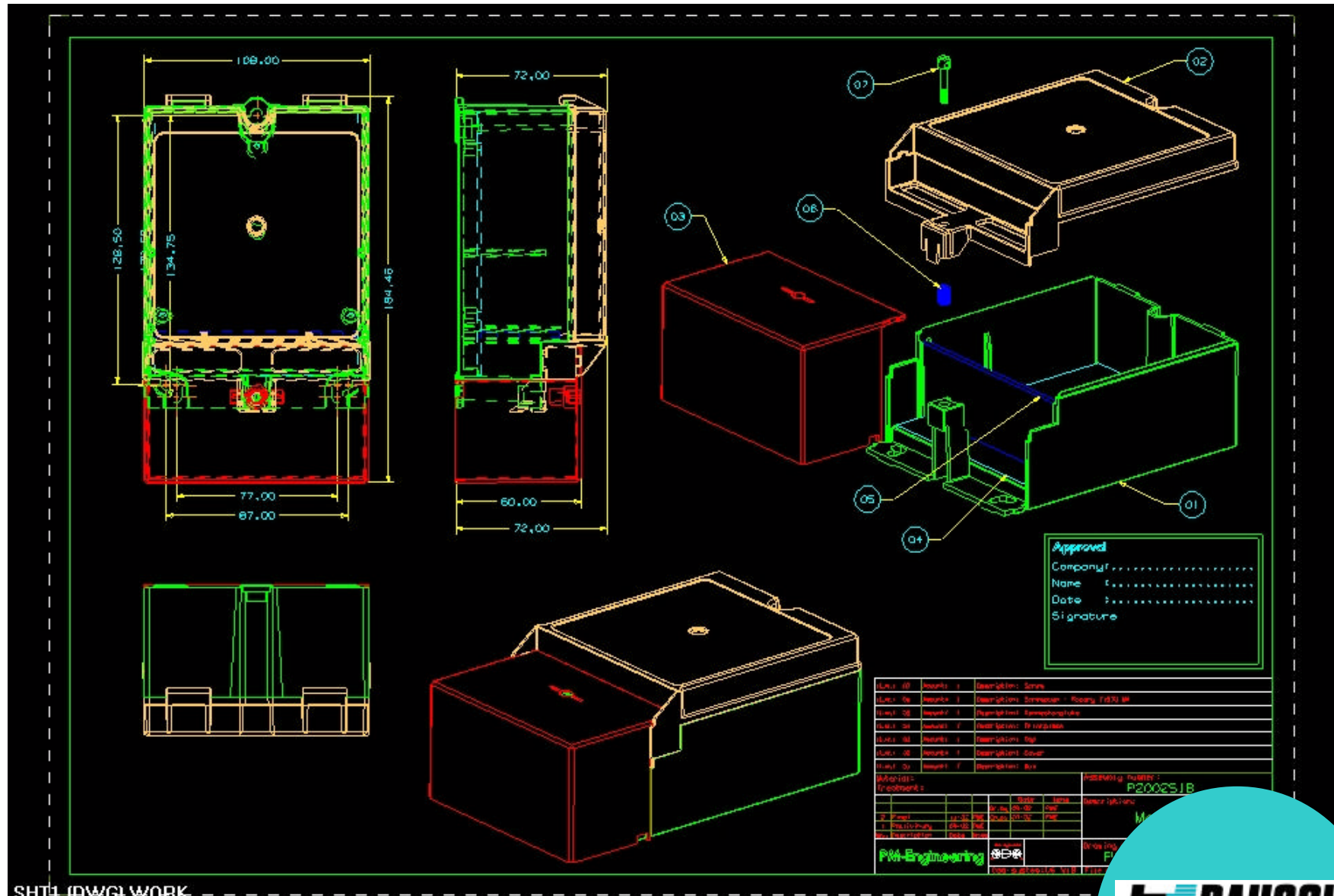
GSMDM-2 GSM modem





GSMMDM-2 GSM modem





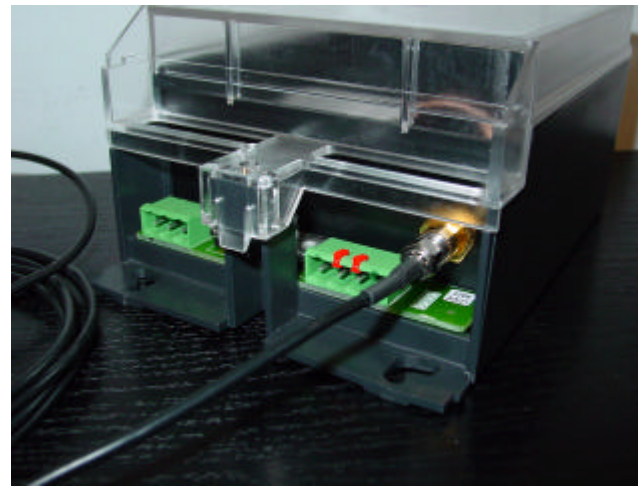
SHT1 (DWG) WORK

InduBox



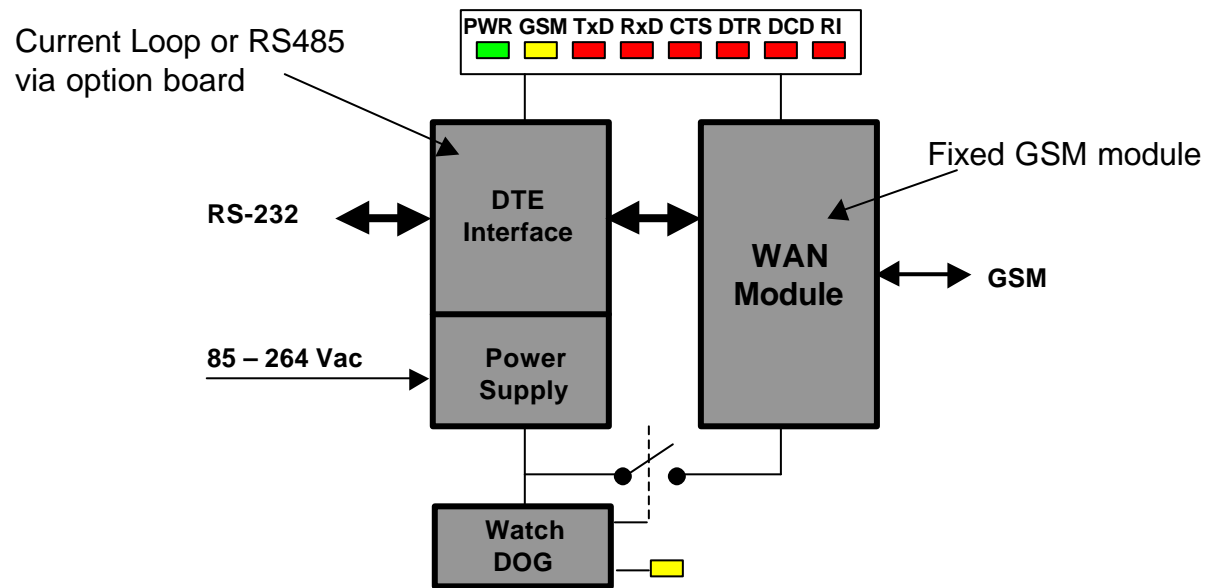
The **InduBox GSM** has the same GSM modem module, interface and power supply specifications as the **GSMDM-2** modem.

The **InduBox GSM** is housed in the new InduBox housing.



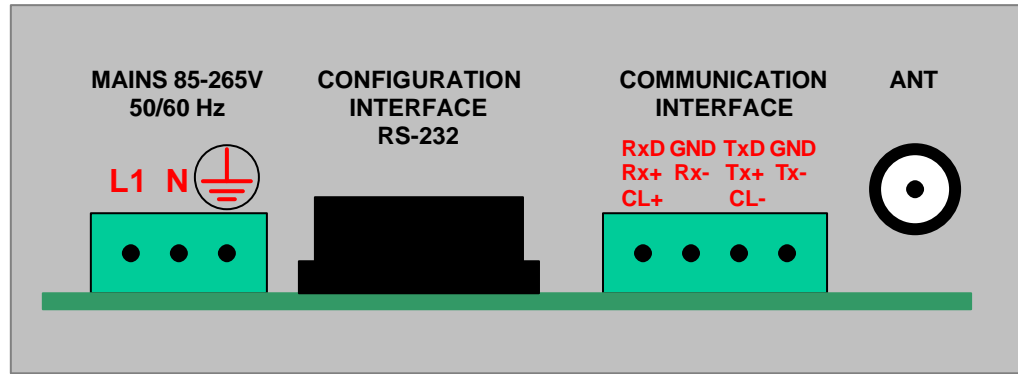
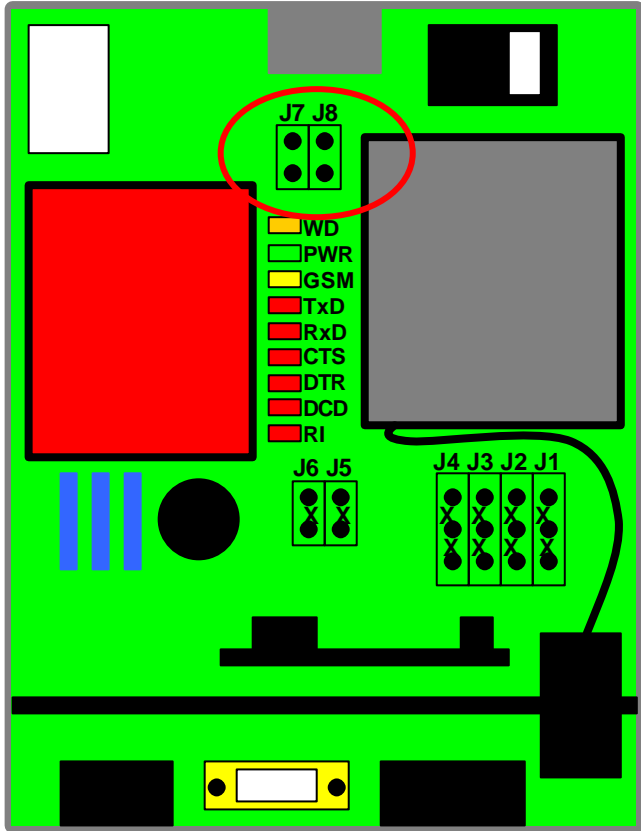
InduBox GSM

**BAUSCH**  
datacom

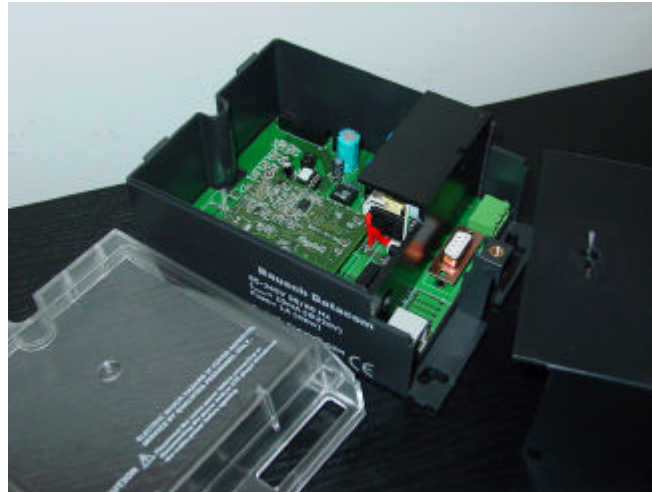


**InduBox GSM**



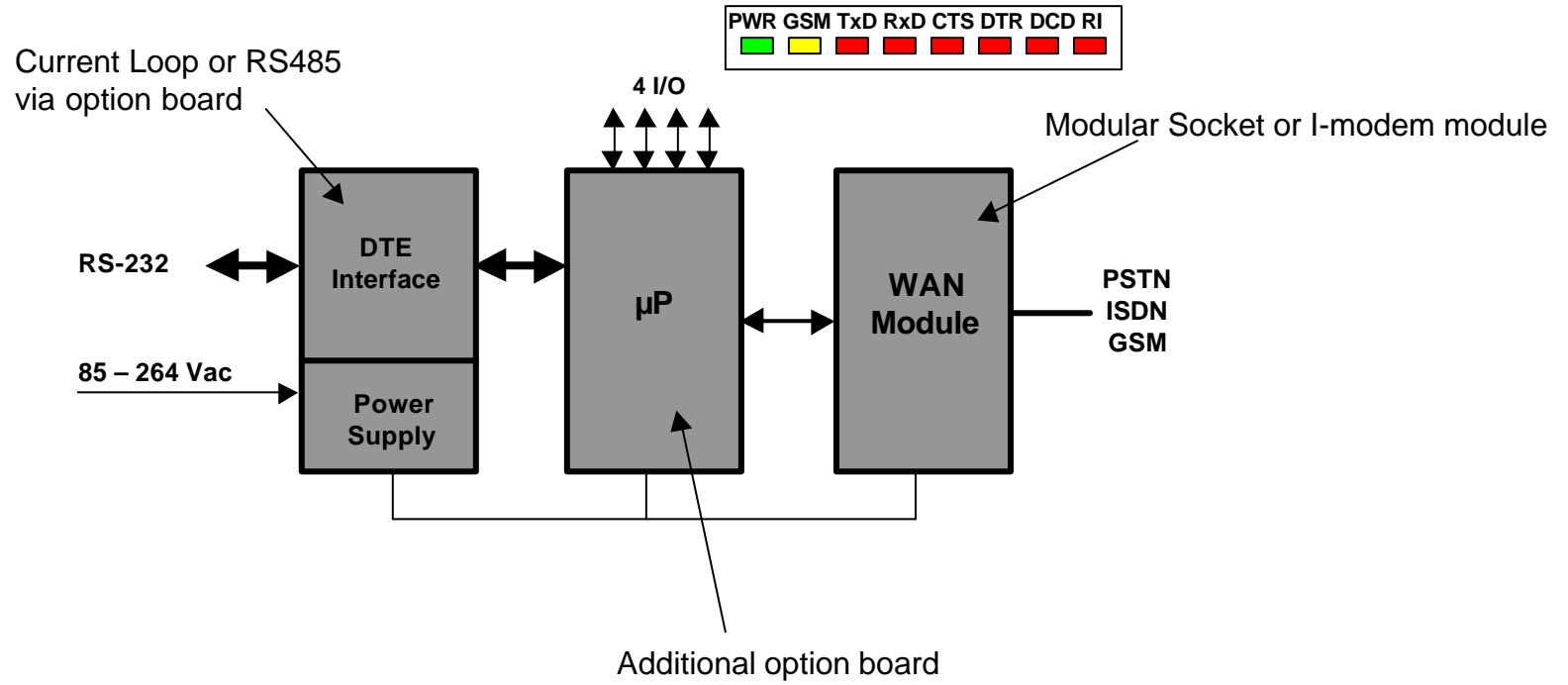


The **InduBox Socket** is designed with -almost- the same modular concept as the **DinLine** modem line but we used the new **InduBox** housing.



InduBox Socket

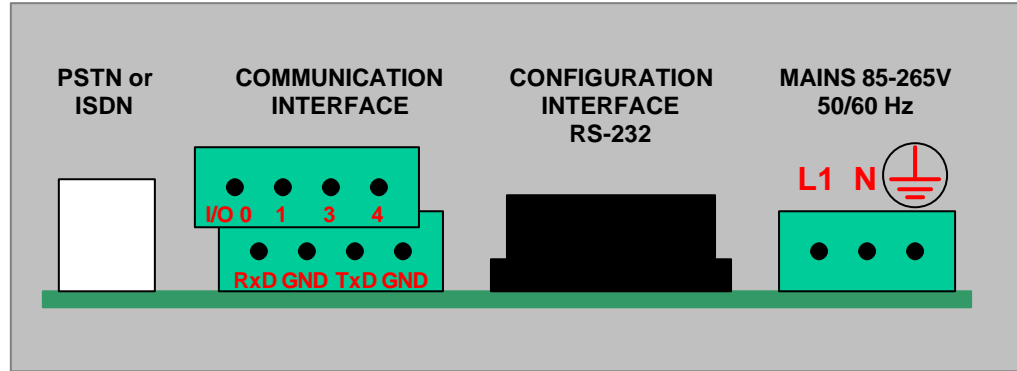
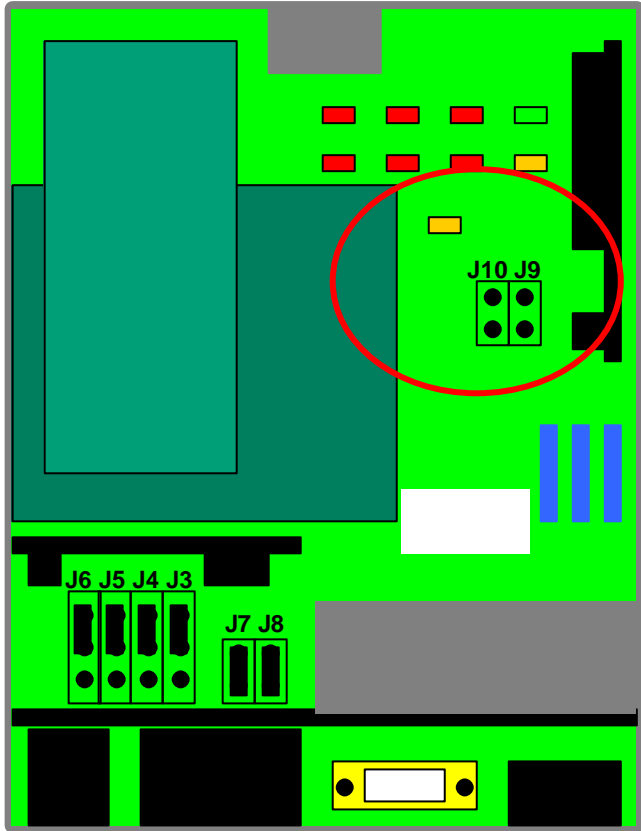




InduBox Socket







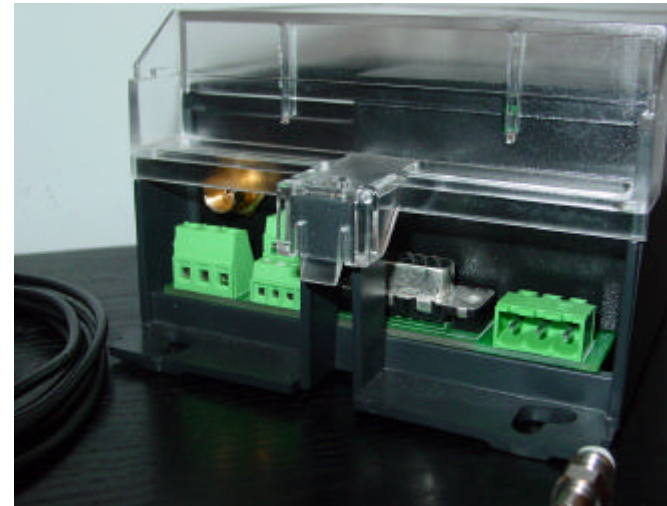
InduBox Socket



The **InduBox GPRS** is the most recent development in the **InduBox** modem line.

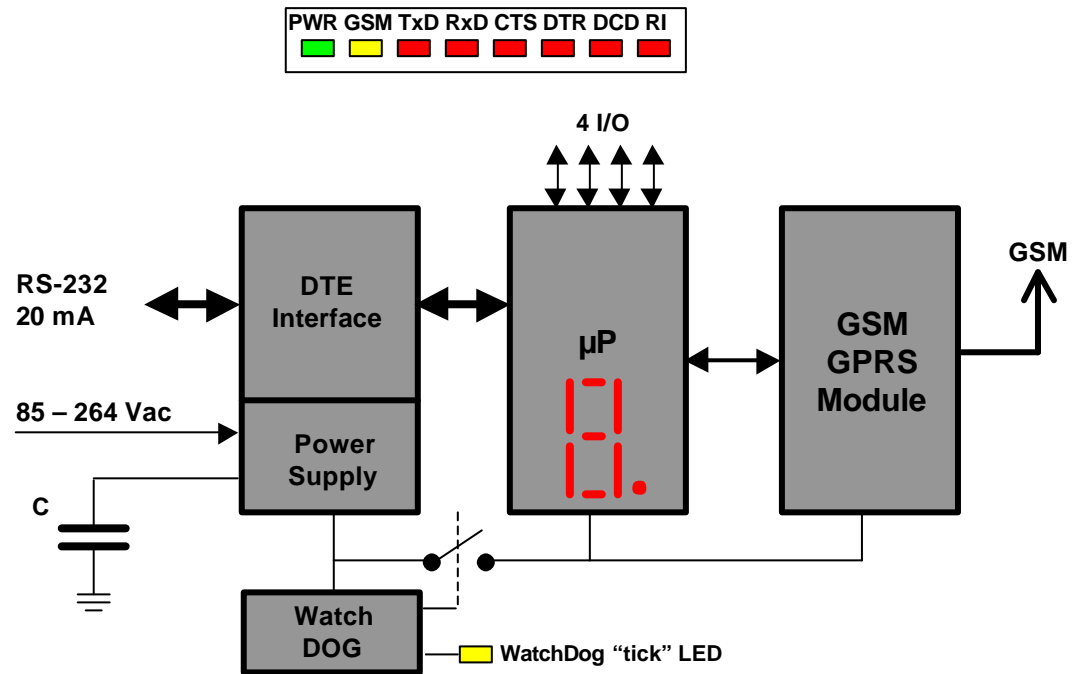
This product has some state-of-the-art features :

- \* Wavecom GSM/GPRS module
- \* embedded TCP/IP
- \* RS-232 interface
- \* optional Current loop and/or RS-485
- \* additional RISC processor to serve 4 I/O lines
- \* wide range power supply
- \* 'long term' watchdog
- \* 7-segment display
- \* SuperCap (50 F) power backup
- \* ...



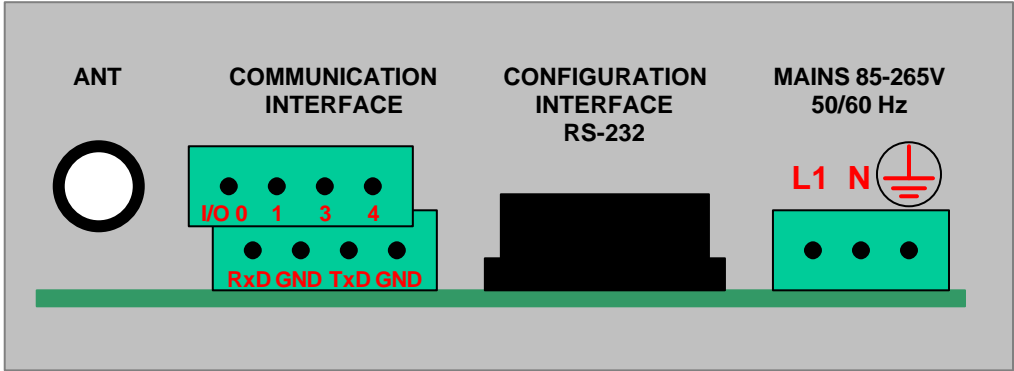
**InduBox GPRS**





InduBox GPRS





InduBox GPRS



The **InduBox Socket** and **GPRS** modem hardware options :

- \* 20 mA current loop
  - 2 or 4 wire
  - 9.600 bps
  
- \* RS-485
  - 2 wire
  - 300 - 115.200 bps
  
- \* wide range AC power supply
  - 90 - 264 Vac
  
- \* DC power supply
  - 10 - 72 Vdc
  
- \* additional RISC processor
  - to serve I/O
  - ADC
  - comparator

---> firmware is custom made for a specific application

Possible InduBox hardware options



## InduBox GPRS enhanced features

GSM DATA connection

Standard GPRS connection with a PC

Standard GPRS connection with a non PPP - TCP/IP terminal

Embedded TCP/IP

Embedded TCP/IP and additional RISC processor to serve I/O

InduBox GPRS configuration samples



## GSM DATA connection

### DATA features :

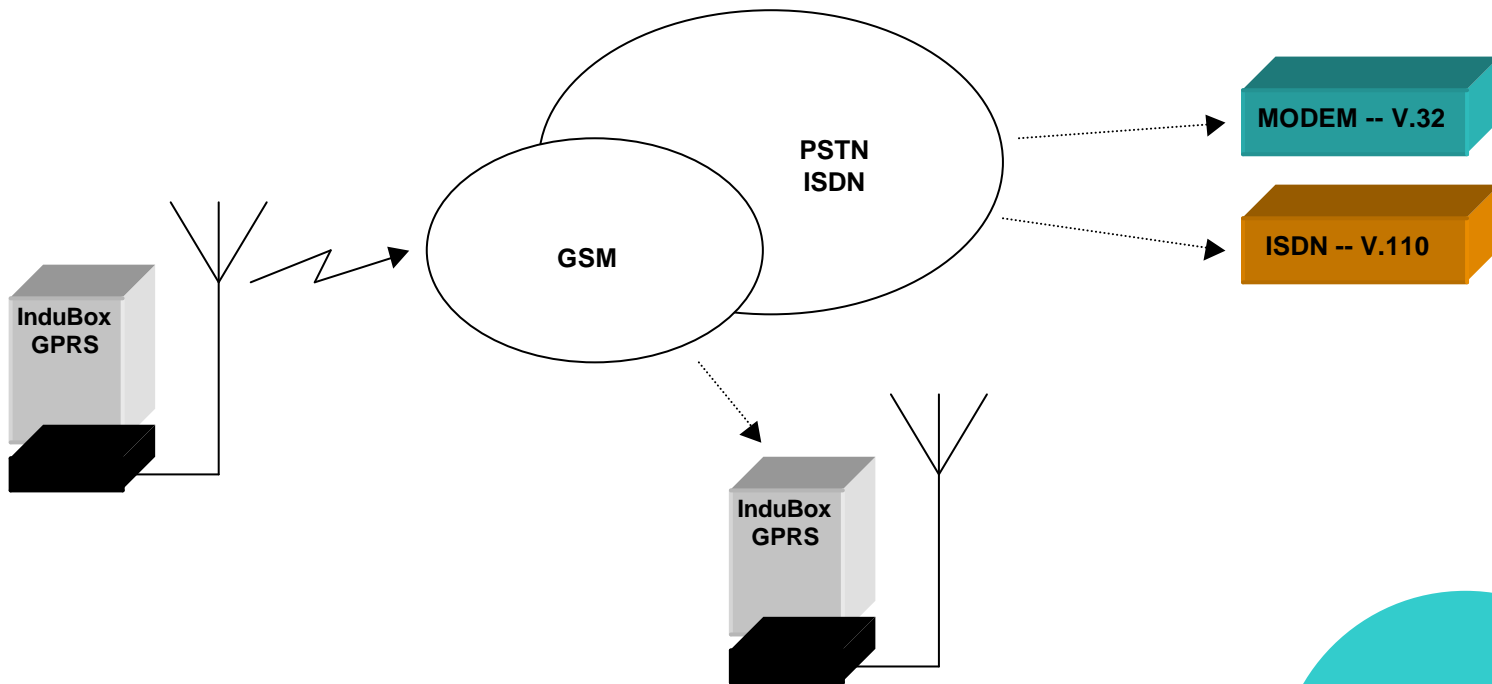
- \* asynchronous
- \* transparent and non-transparent up to 14.400 bps
  
- \* AT commands
- \* S-registers
- \* responses

### FAX features :

- \* Automatic FAX group 3
  
  - \* Class 1 and Class 2 commands
- > acts like a standard PSTN modem

## GSM DATA connection

- > acts like a standard asynchronous PSTN / ISDN modem
- > CIRCUIT SWITCHED connection

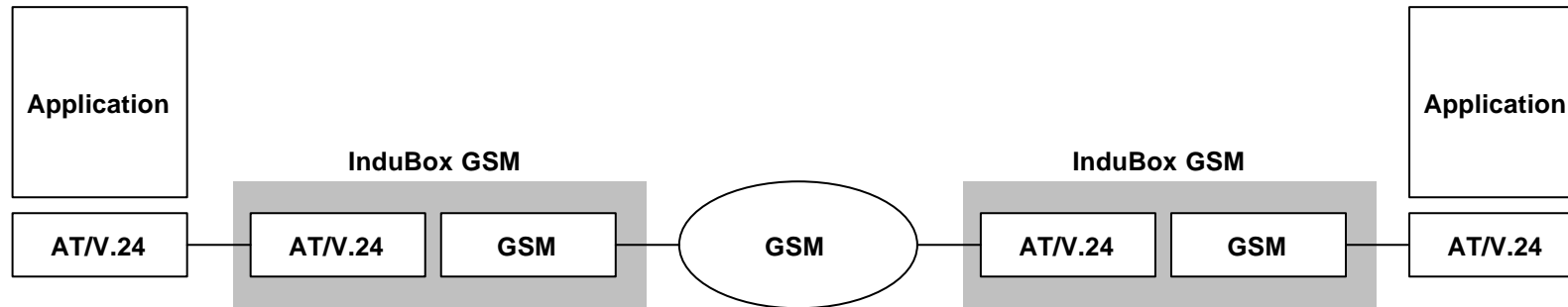


InduBox GPRS enhanced features





## GSM DATA connection



### ORINATION MODEM

<init string>  
OK  
atdt016123456

CONNECT 9600

NO CARRIER

→ transparent data ←

### ANSWERING MODEM

<init string>  
OK

RING  
CONNECT 9600

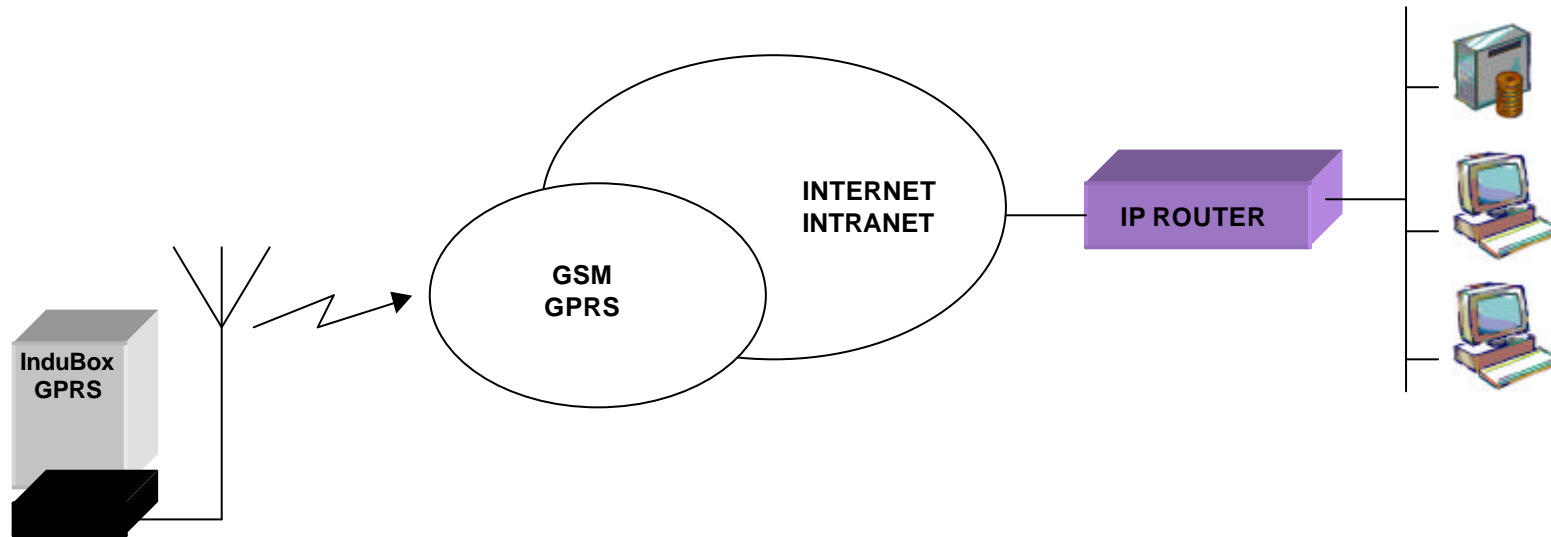
<DTR drop>  
NO CARRIER

InduBox GPRS enhanced features



## Standard GPRS connection

--> PACKET SWITCHED connection

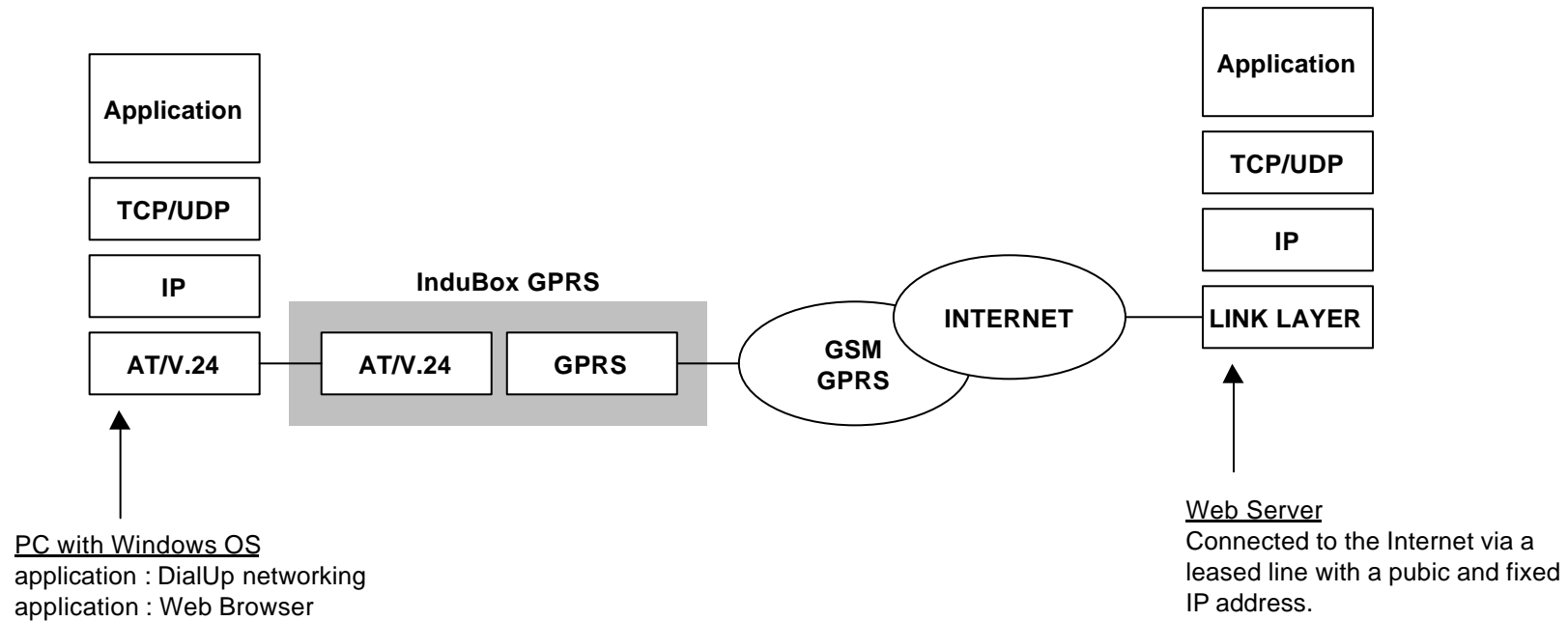


ATDT\*99\*\*\*1#  
start of PPP session  
TCP/IP

InduBox GPRS enhanced features



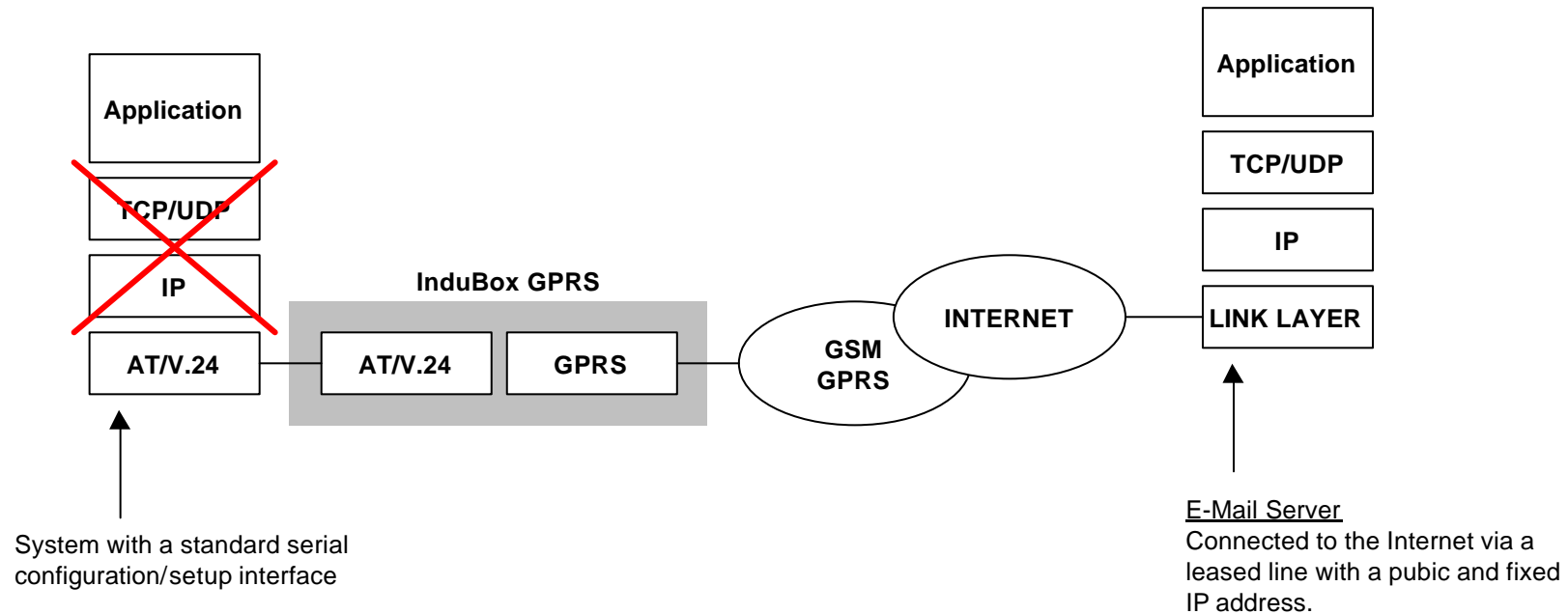
## Standard GPRS connection with a PC



InduBox GPRS enhanced features



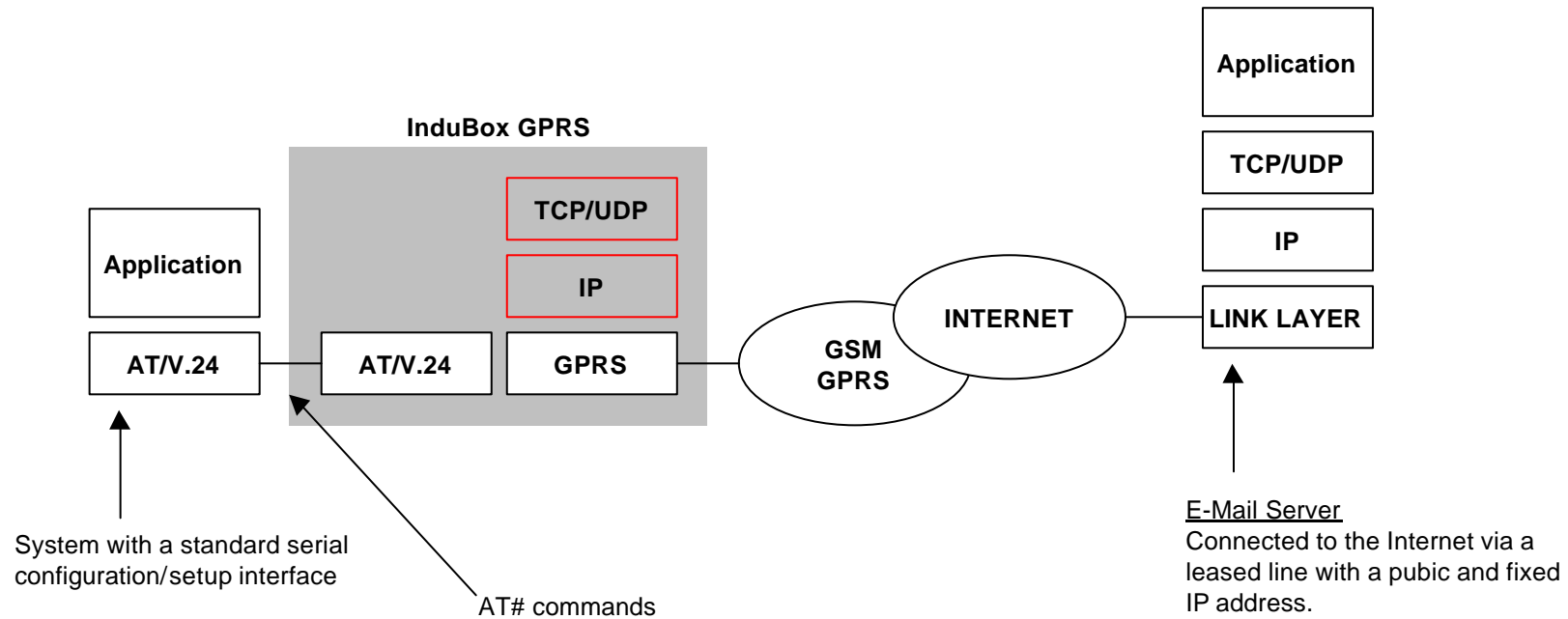
## Standard GPRS connection with a non PPP - TCP/IP terminal



InduBox GPRS enhanced features



## Embedded TCP/IP



InduBox GPRS enhanced features



## **Embedded TCP/IP : Services**

**Integration of TCP/IP stack in the Wavecom module**

**Open AT**

**Application software**

**e-mail  
file transfer  
socket**

**Autonomous software**

**AT like commands  
send through the serial port  
fully compatible with serial non-IP applications**

**TCP-IP**

**RFC compliant  
TCP socket access for specific application**

**DNS client**

**InduBox GPRS enhanced features**

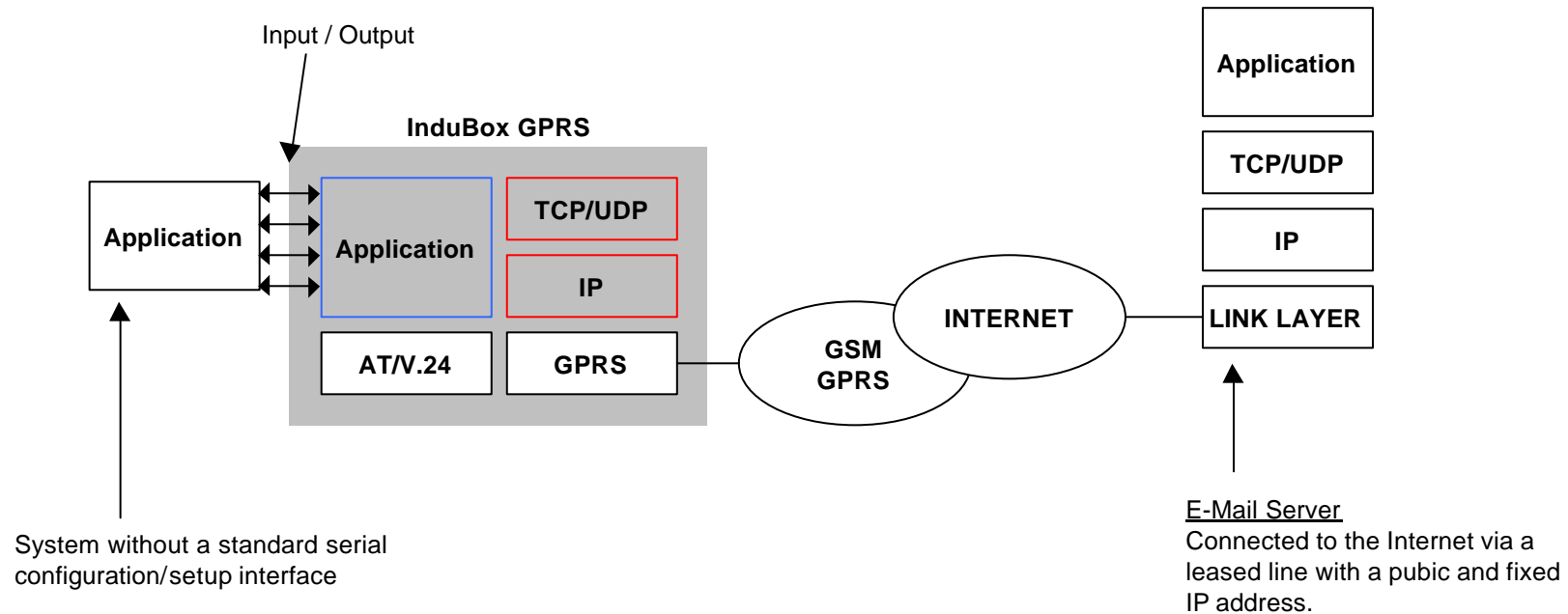


## Embedded TCP/IP : Supported Protocols

<b>Sockets</b>	> defines by an IP address and a port number	TCP port x
<b>FTP</b>	> File Transfer Protocol > data transfer between systems	TCP port 20, 21
<b>Telnet</b>	> Terminal emulation	TCP port 23
<b>POP3</b>	> Post Office Protocol V3 > allows clients to read and remove email from a mailbox	TCP port 110
<b>SMTP</b>	> Simple Mail Transfer Protocol > used to deliver email to a mailbox	TCP port 25
<b>DNS</b>	> Domain Name Solving > dynamic on-demand translation between readable names and the numeric IP addresses	UDP port 53



## Embedded TCP/IP and additional RISC processor to serve I/O

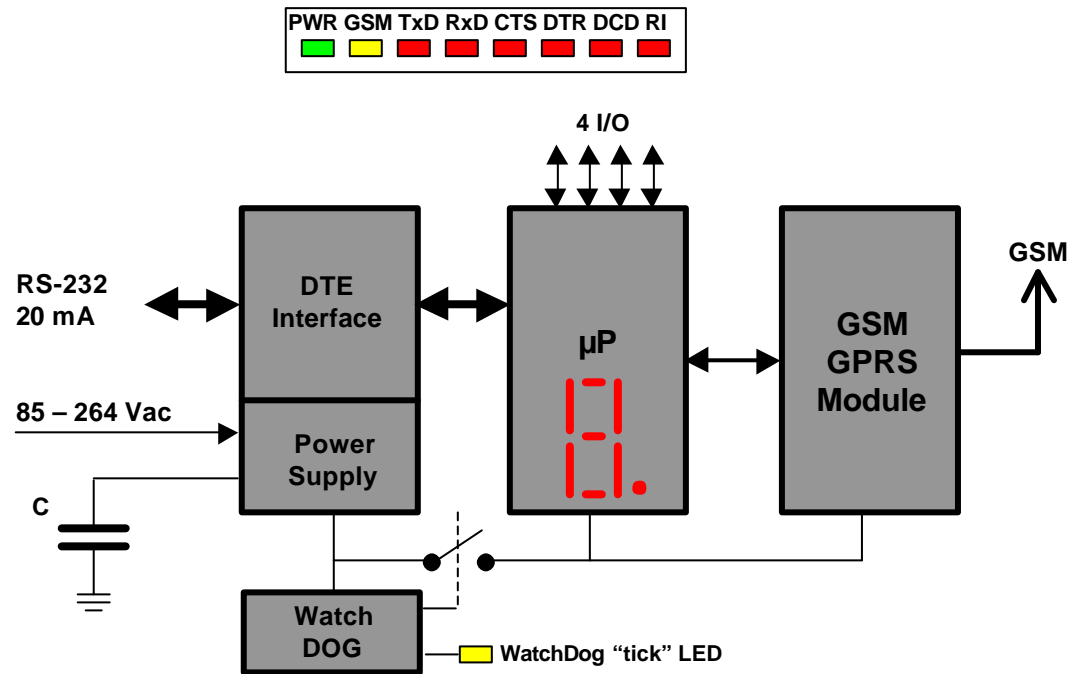


InduBox GPRS enhanced features





## Embedded TCP/IP and additional RISC processor to serve I/O



InduBox GPRS enhanced features



## Embedded TCP/IP and additional RISC processor to serve I/O

### Hardware

Atmel ATmega8L RISC processor

### Integration of specific applications

customer based  
8 K flash

### Application

I/O events (TTL)  
serial events

### Autonomous software

fully compatible with non-serial and non-IP applications

InduBox GPRS enhanced features



## InduBox GPRS configuration samples

It's all about M2M !!!!

What is M2M?

Simply, M2M provides communications between people, devices, and systems and turns data into information companies can act upon.

Whether you call it machine-to-machine, man-to-machine, mobile-to-machine, machine-to-mobile, it's all the same.

What's more, beginning in the mid-1990s the M2M market had also been known as pervasive Internet, telemetry, telematics, device-relationship management, and remote monitoring, among other things.

However, no matter what it is called, in the end, M2M provides communication between people, devices, and systems and that is exactly what M2M is all about.

InduBox GPRS enhanced features



## InduBox GPRS -enhanced- configuration samples

Customer specific applications !!!!

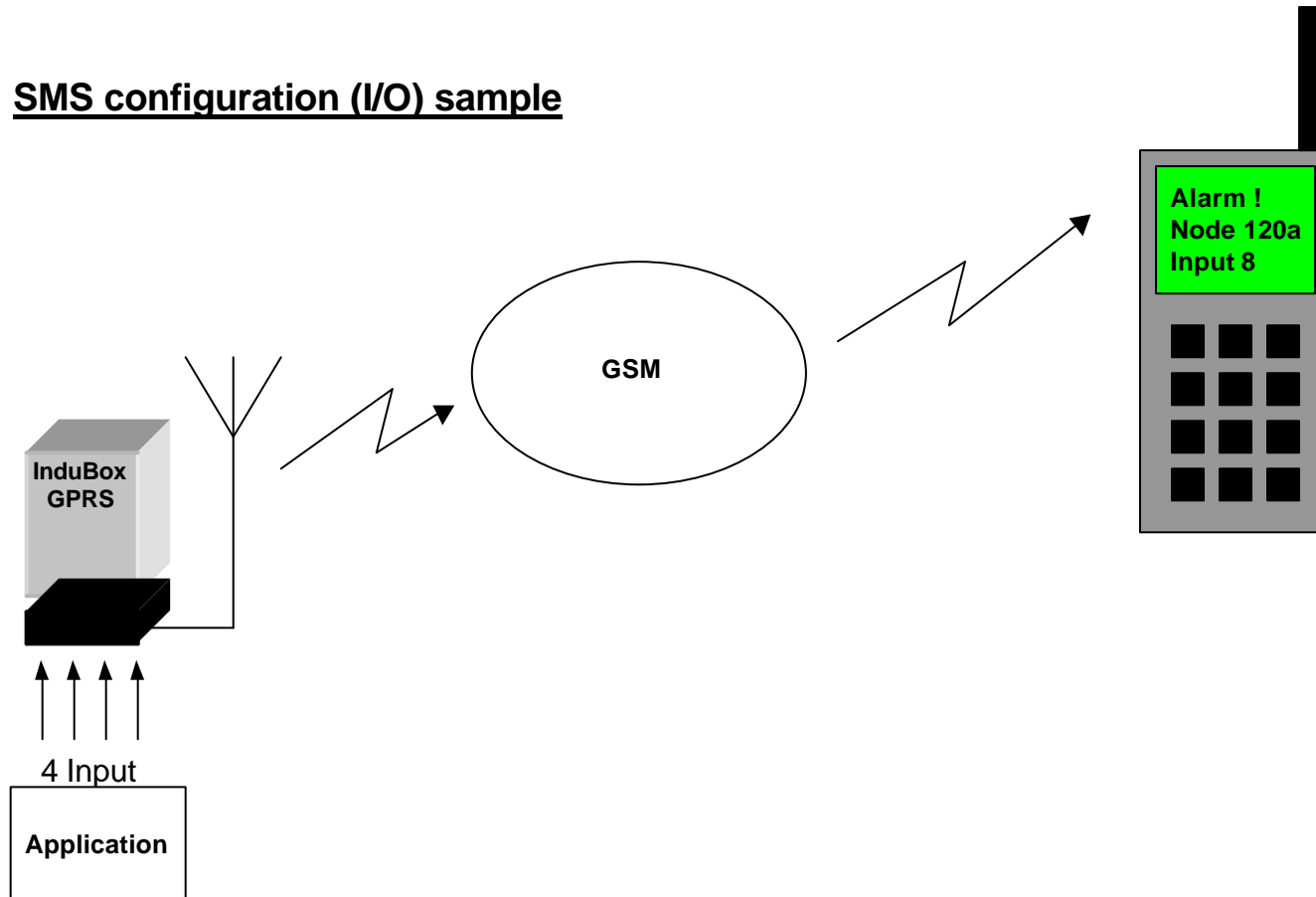
Three standard application possible :

- SMS
- Socket
- GPRS Leased Line

InduBox GPRS enhanced features



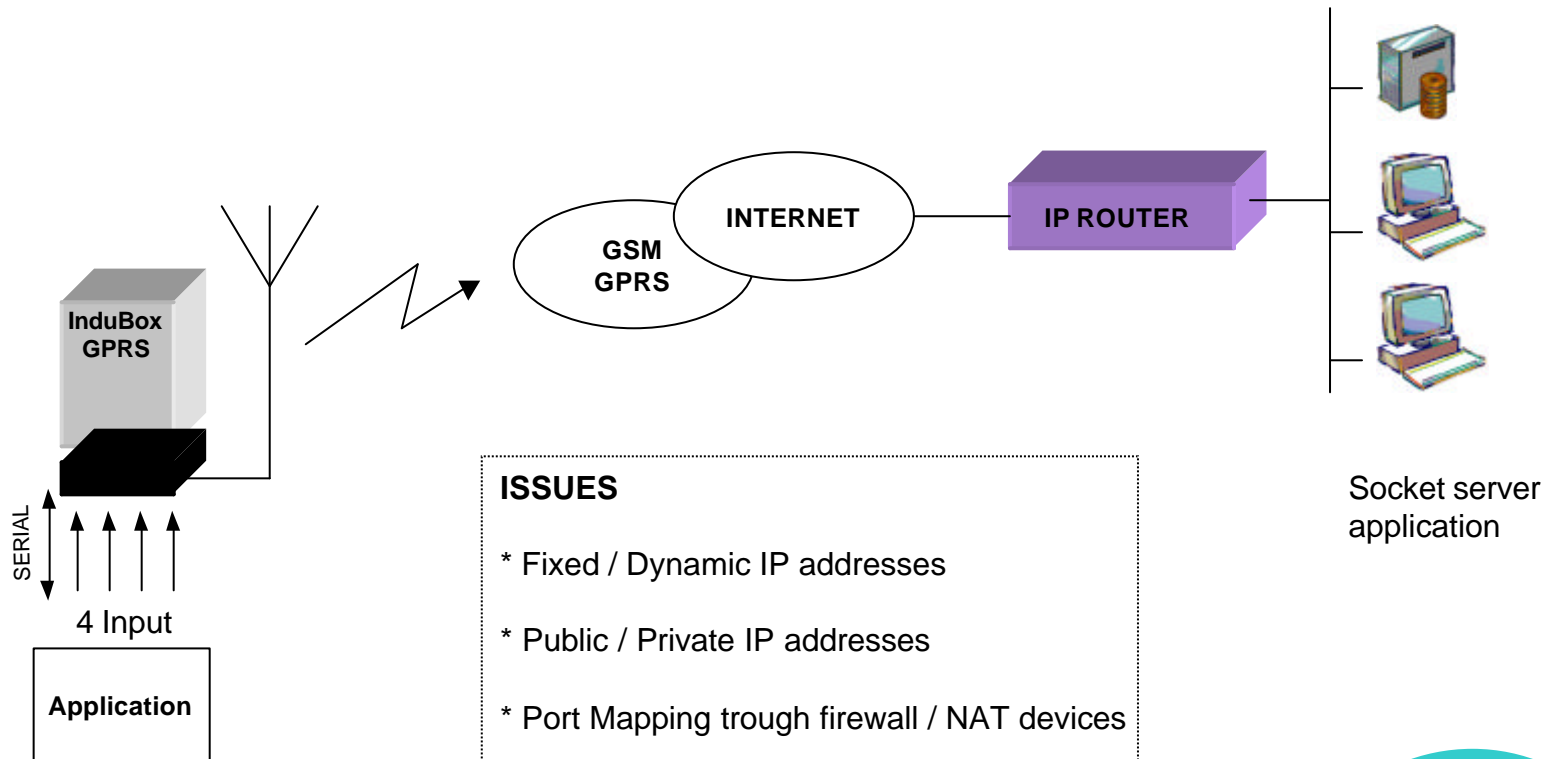
**SMS configuration (I/O) sample**



**InduBox GPRS enhanced features**



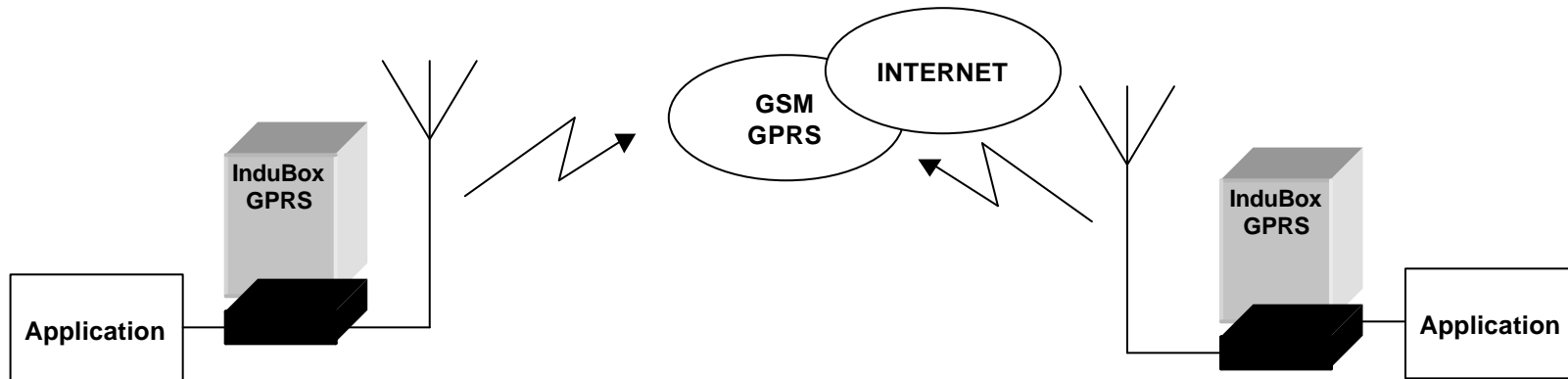
## Socket configuration (I/O) sample



InduBox GPRS enhanced features



## GPRS Leased Line configuration (serial) sample



### ISSUES

- \* Fixed / Dynamic IP addresses
- \* Public / Private IP addresses
- \* GPRS idle times / keep alive !!!!!

InduBox GPRS enhanced features



## **Other standard features**

### **Voice Features (not InduBox GPRS)**

- \* Telephony and Emergency calls
- \* Full Rate, Enhanced Full Rate, Half Rate (FR/EFR/HR)
- \* Echo Cancellation and Noise Reduction
- \* Full Duplex handfree

### **Message services SMS**

- \* Point to point and Cell Broadcast
- \* EMS

### **GSM Supplementary Services**

- \* Call forwarding, Call Barring
- \* Multiparty
- \* Call Waiting, Call Hold
- \* USSD



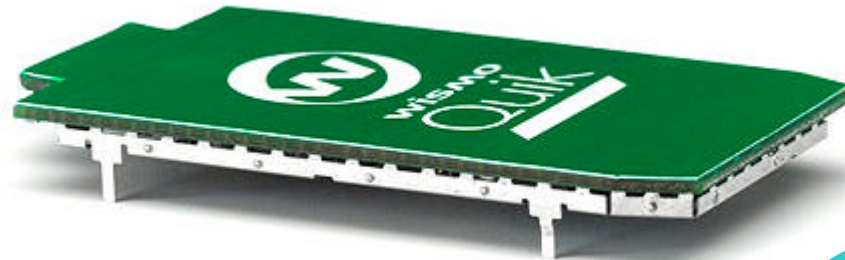
## GPRS Background

What is GPRS

Mobile Station Classes

GPRS bandwidth or data throughput

GPRS Multislot Classes



## **What is GPRS**

The General Packet Radio Service (GPRS) is a new non-voice value added service that allows information to be sent and received across a mobile telephone network. It supplements today's Circuit Switched Data and Short Message Service. GPRS has several unique features which can be summarized as:

### **SPEED**

- \* Theoretical maximum speeds of up to 171.2 kilobits per second (kbps), using all eight timeslots at the same time.
- \* Three times as fast as the data transmission speeds = ten times as fast as current Circuit Switched Data.
- \* GPRS may well be a relatively less costly mobile data service compared to SMS and Circuit Switched Data.

### **IMMEDIACY**

instant connections whereby information can be sent or received immediately as the need arises

GPRS users are sometimes referred to be as being "always connected"

High immediacy is a very important feature for time critical applications such as remote credit card authorisation where it would be unacceptable to keep the customer waiting for even thirty extra seconds.

### **NEW APPLICATIONS, BETTER APPLICATIONS**

GPRS will fully enable the Internet applications you are used to on your desktop from web browsing to chat over the mobile network.

Other new applications for GPRS include file transfer and home automation- the ability to remotely access and control in-house appliances and machines.

## Mobile Station Classes

The class indicates the mobile phone capabilities.

### **Class A**

Class A mobile phones can be connected to both GPRS and GSM services simultaneously.

### **Class B**

Class B mobile phones can be attached to both GPRS and GSM services, using one service at a time. Class B enables making or receiving a voice call, or sending/receiving an SMS during a GPRS connection. During voice calls or SMS, GPRS services are suspended and then resumed automatically after the call or SMS session has ended.

### **Class C**

Class C mobile phones are attached to either GPRS or GSM voice service. You need to switch manually between services.

#### **InduBox GPRS**

based on Wavecom Wismo Q2406

AT+CGCLASS=?

B - Class B

CG - Class C in GPRS mode only

CC - Class C in GSM data mode only

Class A is NOT possible

## GPRS bandwidth

The class of the device determines the speed at which GPRS can be used.

For example, the majority of GPRS terminals will be able to download data at speeds of up to 24Kbps (kilobytes per second). At the higher end, speeds are theoretically possible up to 171.2 kbit/sec when 8 slots are assigned at the same time to a single user. In reality 40-50Kbps.

Compare this to current data speeds available :

	UPLINK	DOWNLINK
<b>GPRS</b>	14 kbps	28-64 kbps
<b>GSM CSD</b>	9.6-14 kbps	9.6-14 kbps
<b>HSCSD</b>	28 kbps	28 kbps
<b>Dial-UP</b>	56 kbps	56 kbps
<b>ISDN 1B</b>	64 kbps	64 kbps
<b>ADSL</b>	256 kbps	512 kbps
<b>Broadband</b>	2 Mbps	2 Mbps

## GPRS Multislot Classes

Multislot classes are product dependant, and determine the maximum achievable data rates in both the uplink and downlink directions.

Written as (for example) 3+1 or 2+2

**first number** indicates the amount of **downlink timeslots** (what the mobile phone is able to receive from the network)

**second number** indicates the amount of **uplink timeslots** (how many timeslots the mobile phone is able to transmit)

The active slots determine the total number of slots the GPRS device can use simultaneously for both uplink and downlink communications.

Multislot Class	Downlink	Uplink	Active
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5

### InduBox GPRS

based on Wavecom Wismo Q2406

#### GPRS CLASS10

1 up                      4 down  
8 - 24 Kbps              32 - 48 Kbps

2 up                      3 down  
16 - 24 Kbps             24 - 36 Kbps

## Coding Scheme

Up to 4 different channel coding schemes are defined in the GPRS specifications.

different level of data integrity checks (error correction overhead)  
labelled from CS1 to CS4  
variation of size of the radio block

--> there is an inverse relation between the amount of data and the data integrity assurance  
--> coding scheme with the least protection will have the highest throughput

The trade-off of throughput versus error protection is an important capacity parameter that depends on the user's location, in relation to the base station picking up the strongest signal from the user (usually the nearest base station).

It is the base station that calculates which channel coding scheme that should be used.  
It is important to know that CS4 incorporates NO error correction.

Coding Scheme	Data rate per time slot Kb/s
CS1	9.05
CS2	13.4
CS3	15.6
CS4	21.4

### **InduBox GPRS**

based on Wavecom Wismo Q2406

CS1 to CS4 are supported

[www.gsmworld.com](http://www.gsmworld.com)  
[www.wavecom.com](http://www.wavecom.com)  
[www.ericsson.com](http://www.ericsson.com)

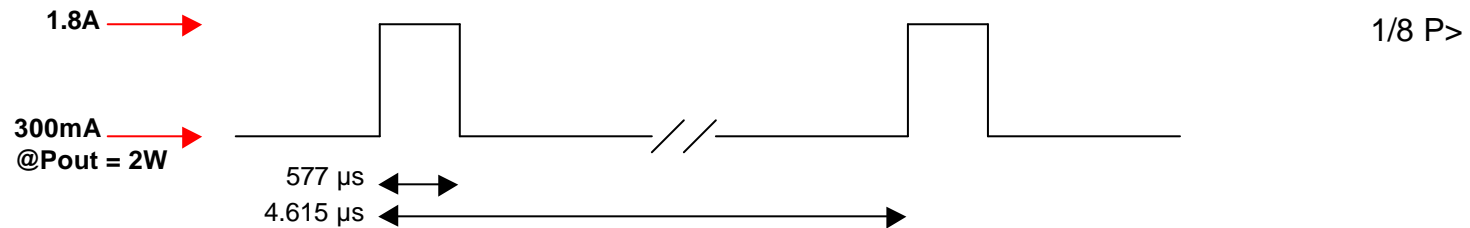
Blank Page



## GSM Modem Power Consumption

The power supply is one of the key issues in the design of a GSM modem. Due to the bursted emission in GSM/GPRS the power supply must be able to deliver high peaks in a short time.

### GSM DATA & GPRS Class 2 mode



### GPRS Class 10

