

PCD3 Wide Area Controller

WAN Networking Guide

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1 Introduction

The purpose of this document is to provide the user of the PCD3.WAC with the basic knowledge required to order the appropriate subscriptions from telecommunications providers and take the correct steps to put the PCD3.WAC into operation successfully. To understand the document, you need a basic grounding in network technology and the TCP/IP protocol.

Section 2 provides a summary of the supported communication technologies that can be used in conjunction with a WAC to create WAN connections.

Section 3 covers the subject of GSM/GPRS in detail. While there is great demand in this area, there are also major differences in the design of the networks among the telecommunication providers. There are a number of points to note here in order to set up effective systems.

Section 4 covers applications and supported protocols.

The subject of Section 5 is the products and options offered by telecommunications providers.

2 Supported WAN communication technologies

Four different types of PCD3 Wide Area Controller are available. Every model has an integrated modem with which WAN connections can be established over a provider's telecommunications network.

PCD3.M2230A4T5	GSM/GPRS (EDGE) modem
PCD3.M2330A4T1	Ethernet, PSTN modem
PCD3.M2330A4T3	Ethernet, ISDN modem
PCD3.M2330A4T5	Ethernet, GSM/GPRS (EDGE) modem

2.1 Wired Wide Area Automation

Where wired communication with a telecommunications provider is available at a location, this technology should be preferred to wireless connections because the connection quality is better.

You may also wish to use GSM to optimise costs; however, you will then have to accept certain restrictions in the quality of communication. For applications where the availability of the connection is very important, a wired connection should be provided as the normal communication channel with a GSM / GPRS channel as a backup.

2.1.1 PSTN modem

The **WAC with integrated PSTN modem** (**PSTN** stands for **Public Switched Telecommunications Network**) can be run over a normal telephone line. Depending on whether the device is attached to a trunk line or an (internal) PBX (Private Branch Exchange), the functionality may be more or less restricted. It may be that no incoming calls will be accepted, or outgoing calls may be wholly or partly blocked. There are also (internal) exchanges that have to be specially configured in order to run modems and fax machines. A dedicated trunk line has the advantage that the behaviour and capabilities of such a line are well known, which is not always the case with connections through a PBX. Where the reliability of the alarm function is a key criterion, you should use a separate line, as the (internal) exchange is an additional link in the chain that could restrict the function.

The WAC model with the integrated PSTN modem is the PCD3.M2330A4T1

2.1.2 ISDN modem

With the **WAC with ISDN modem**, the problem is similar to the PSTN version. ISDN stands for **Integrated Services Digital Network**. When an ISDN line has been ordered, the provider usually supplies a device which is needed to operate a modem or ISDN telephone. This device is called a Network Termination for ISDN Basic Rate Access (NTBA) (in Switzerland, NT2ab). It is possible to connect multiple ISDN devices and 2 analogue devices to this adapter. ISDN connections offer approximately twice the speed of analogue point-to-point connections. With analogue point-to-point connections, you are limited to a speed of 33600 bit/s, while ISDN point-to-point connections using a B channel can reach a speed of 64 kBit/s. In principle, the two existing B channels can be combined. If you have to transmit larger volumes of data, ISDN is an advantage. For connections to the Internet provider's digital modems, there is only a small difference in speed between analogue (56 kBit/s) and ISDN connections (64 kBit/s). The advantages of ISDN are particularly the fast connection setup and better quality.

The WAC model with the integrated ISDN modem is the PCD3.M2330A4T3

2.1.3 WAC with Ethernet port

Another alternative with wired connections is a **broadband line, e.g. with xDSL**. With this technology, the existing transfer capacity of normal copper cable trunk lines is much better utilised. These are always Internet connections. By connecting an xDSL router to the Ethernet port of a WAC, you can achieve much higher transfer rates than with analogue or ISDN modems. As you only have to pay a fixed amount per month, communication costs are easier to calculate. A drawback of xDSL that is often overlooked is that, in contrast to a modem connection, you no longer have a password-protected private communication channel as standard. You have to create such channels yourself using VPNs (Virtual Private Networks). This generally requires additional hardware, which is not normally included in the xDSL package. The use of a modem with an integrated firewall or an additional external firewall is strongly recommended.

The following WAC models have an Ethernet port: PCD3.M2330A4T1, PCD3.M2330A4T3 and PCD3.M2330A4T5

2.2 Wide Area Automation with wireless connection

Where a communication connection over wires is not possible because the unit is to be placed in an area that is not served by the fixed network, you should use the WAC with GSM / GPRS modems. WACs with GSM / GPRS are also well suited for use as a communication backup.

The specific characteristics of these devices that you need to be aware of are covered in the next section.

3 WAC versions with GSM/GPRS modem

3.1 Wireless network connection

The following types in the PCD3 Wide Area Controller series:
PCD3.M2330A4T5 and PCD3.M2230A4T5
can use the functions of the GSM mobile communication network.

The GSM versions of the Wide Area Controller can be used in locations where there is reception from a GSM network. If you can use mobile phones with the GSM standard, and the signal strength is sufficient, you should also be able to use a PCD3 Wide Area Controller.

GSM (Global System for Mobile Communications) is the best-known standard for mobile communication. Its share of the global mobile communications market is about 80%. GSM is now available in around 200 countries.

The PCD3.M2330A4T5 and PCD3.M2230A4T5 have an integrated quadband GSM/GPRS modem. The following frequencies are supported: 850 MHz, 900 MHz, 1800 MHz, 1900 MHz. It should be possible to use them in Europe without any restrictions. It is advisable to check that there is good GSM reception at the desired location. If the devices are to be used in America, Asia, Africa or Australia, you should check beforehand what frequencies are available and whether you need to apply for additional licenses.

The PCD3 WAC can use the following services provided by GSM mobile network providers:

SMS	Short Message Service
CSD	Circuit Switched Data
GPRS	General Packet Radio Service
EDGE *	Enhanced Data Rates for GSM Evolution (E-GPRS)

* WACs with EDGE will be available from 2009

In order to operate the PCD3.M2330A4T5 and PCD3.M2230A4T5 devices, you need a SIM card from a mobile network provider. Depending on the communication service that you want to use, you should ask for the appropriate subscription from the provider. There are subscriptions that support SMS, CSD and GPRS. Voice may also be supported, but there is no benefit in this, as it is not supported by the WAC. There are subscriptions that only support CSD and SMS, and others that only support SMS. If you limit yourself to a few services, the price of the subscription should be quite affordable. Many operators offer attractive framework contracts for sufficiently high volumes.

3.2 Difference between GSM (CSD) and GPRS (PSD)

With CSD (**Circuit Switched Data Service**) a “channel” is established temporarily. The baud rate over this channel is 9600 baud. By using other coding schemes and bundling channels (high-speed CSD, or HSCSD), a higher baud rate can be provided for data communication. This must be supported by the hardware and the operator. A channel is established from A to B. The two devices are addressed by their telephone numbers, as is usual with fixed line communication.

The costs are calculated per time unit; the exact formula may vary according to the operator. For example, there may be a cost element per call + a time element in seconds or minutes (rounded).

With PSD (**P**acket **S**witched **D**ata **S**ervice), IP packets are transmitted.

GSM networks can offer the following PSD services: GPRS and EDGE. Not all providers have expanded their infrastructure to include EDGE. No transparent data channels are established as with CSD. It is not possible simply to exchange data between two terminals.

Operators usually bill the communication costs for PSD by data volume and not by time as with CSD.

With GPRS transmission, you are not allocated a constant bandwidth as with CSD communication. A certain number of channels in each wireless cell are reserved for the whole IP packet traffic to and from all signed-on GPRS terminals. The more devices are communicating via the same wireless cell, the smaller the bandwidth available to any individual device.

For operators, voice communication always has the highest priority for commercial reasons. The GSM system has not been optimised for data transfer.

3.3 Conventional GSM (CSD, SMS)

3.3.1 Principle

The following functions of pure GSM operation (CSD, Carrier Switched Data) are normally possible with any standard SIM card:

- sending and receiving SMS messages
- calling another controller (master)
- remote access to a controller (e.g. access to a PCD via PG5 on a PC with a GSM modem)

In order to receive a call with a GSM modem, you need a data number. This function is required for a "Public Line Modem" (S-BUS) or a PPP server that is to receive incoming calls. We then refer to data SIM cards or to a SIM card with data number. You may be given a single number which is also a data number or a second (data) number, with the first number used for voice.

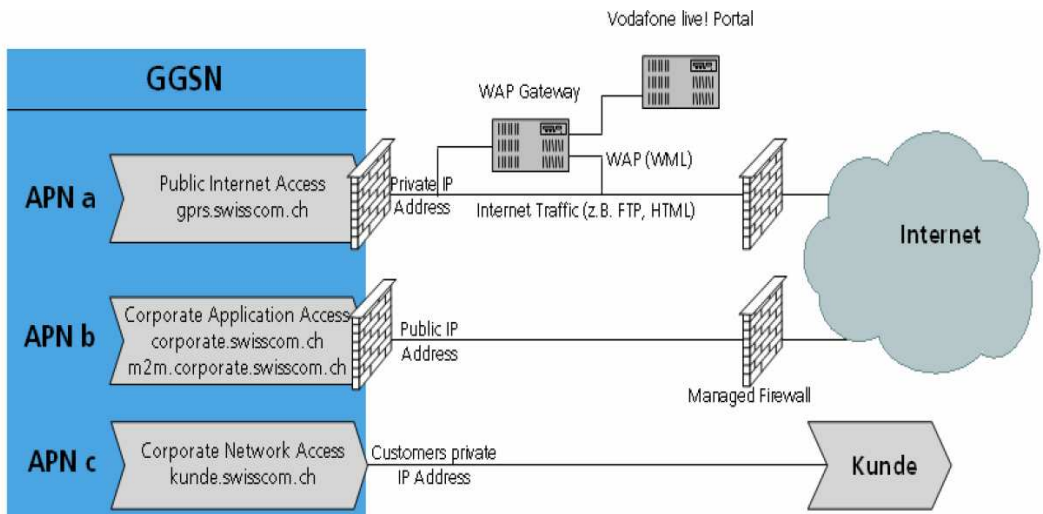
3.3.2 Example (provider: Swisscom)

For normal subscriptions with monthly billing (e.g. Swisscom Natel Swiss Liberty), a data number can be ordered as an add-on (price approx € 2-5 per month). There are also pure data SIM cards (e.g. Swisscom Databasic). These cards allow you to perform all model functions, but the card cannot be used in a mobile phone to make voice calls. The costs with Swisscom are approx. € 7 per month. Swisscom offers the Dataflex product with no monthly basic charge (the price of the SIM card is € 25).

Conventional GSM functions				
General name	Data SIM card	Prepaid SIM card	SIM card with billing	Remarks
Name of product from Swisscom (Swiss provider)	data basic (data flex)	Natel Easy	Natel Swiss Liberty,	
Send SMS	yes	yes	yes	
Receive SMS	yes	yes	yes	
Make call (e.g. S-BUS master)	yes	yes	yes	
Receive call (e.g. S-BUS slave)	yes	no	no *	* optional data number

3.4 GPRS (PPP, IP)

3.4.1 GPRS principles



[Kunde = Customer]

Most operators provide the mobile subscriber with various access points to the GPRS network. These are called APNs (Access Point Names). The APN defines what access the subscriber is given to the network.

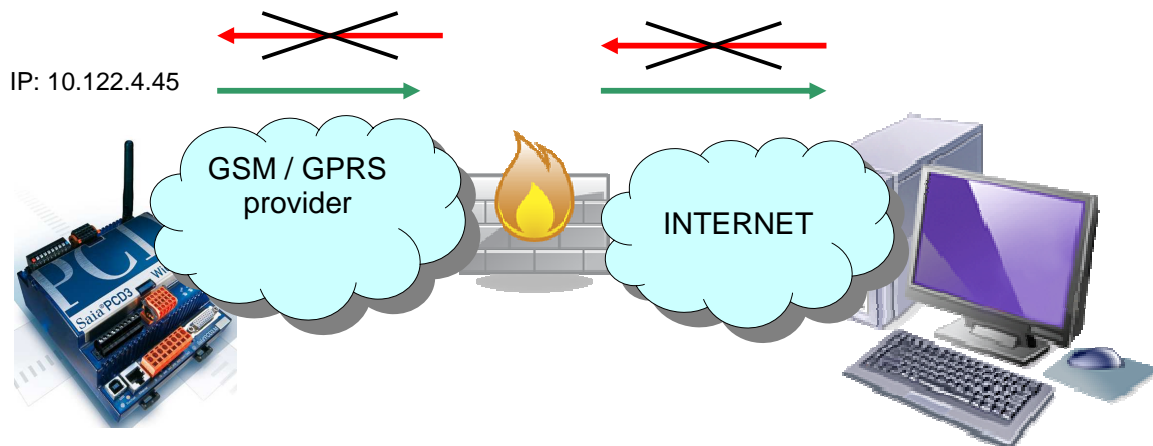
The figure above shows 3 major APNs in the Swisscom network. The majority of users use APN a (gprs.swisscom.ch). The more specialised APNs are APN b (corporate.swisscom.ch) and APN c (kunde.swisscom.ch). There are further APNs for things like Blackberry devices.

The operator creates the profiles for the SIM cards and can define which APNs you can use with a particular contract.

3.4.2 Public Internet Access (APN a)

Public Internet Access is the name Swisscom uses for its standard Internet access. Other network providers often use the simple name "Internet" for this type of APN. This kind of access is offered by most operators in the basic package. Only a few low-cost operators have SIM cards in their package that explicitly do not support any GPRS functions and so can offer cheaper rates for the other services that they support (e.g. M-Budget Mobile in Switzerland).

GPRS always involves IP communication. As the GSM/GPRS operators only have a limited number of public IP addresses, there is a feature of GPRS connections that you do not generally find with xDSL or dialup connections. The majority of operators provide the customer with IP accesses connected via a NAT router and firewall. These addresses are allocated dynamically from a pool of private addresses (e.g. 10.x.x.x). Outgoing Internet functions can generally be used without any problem, but it is not possible to reach the devices via the Internet as they only have a private address. The operator may allow only the most common outbound functions (e.g. web access and e-mail) while blocking other protocols and ports. In this case, you need to enquire whether the operator offers an alternative APN on which the required ports are not blocked.



3.4.3 Corporate Application Access (APN b)

Swisscom offers another APN called Corporate Application Access. You can use this APN if you subscribe to a fee-liable additional service. This is an APN from which you are assigned a temporary public IP address. If the connection is broken and re-established, you receive another free address from a pool of public addresses. With this kind of address, you can be reached anywhere on the Internet. Swisscom expressly advises against using this access without a customer-specific firewall profile, which you can have set up for your own needs. With this profile, you can avoid paying for network traffic that you have not generated yourself, while also minimising the risk of attack by third parties over the Internet.

The security options are not however unlimited. You can restrict access from the Internet to certain addresses or address ranges, but it is not possible to set firewall rules for communication between different RTUs, as their IP addresses are variable and the firewall rules are static. The details of these special APNs, which are not intended for the average user, are not generally presented on the Internet. As a rule, you have to contact the operator personally to order this additional subscription and define the configuration profiles for the “managed” firewall. As this demands a good deal of administrative effort, the telecommunications providers prefer you not to have to declare a new firewall profile for every installation, but rather to use the same profile for a large number of SIM cards.

3.4.4 Corporate Application Access (APN c)

This access is actually intended for employees of companies that want to access their corporate LAN remotely.

This is then a network connection that could be seen as an extension of the corporate LAN into the mobile network. Security for such a network is set up centrally. A VPN connection is established over the Internet, without the terminals having to support VPN. With this solution, however, part of the infrastructure has to be located on the customer’s premises. The customer needs a corporate LAN, which can theoretically comprise just a firewall and an xDSL router. Different variants may be set up to assign addresses to the RTUs. As dynamic address assignment is not ideal for PCDs, the option of a Radius server at the provider (fee-liable) or a Radius server at the customer may be considered. The radius server service for configuring the addresses of mobile devices can be installed on a Microsoft Windows server, for example.

4 WAC applications

4.1 Applications supported by the PCD3 WAC

The table below lists frequently used applications, communication processes and protocols that are supported by the WAC.

Application (function)	PSTN	ISDN	GSM	GPRS (with PPP only)	xDSL (broadband router), additional hardware	Further comments
Sending and receiving SMS messages	Can only send; modem library, FBox	Can only send; modem library, FBox	Modem library, FBox	With active PPP profile; with special FBox only	Via Ethernet TCP/IP (e.g. SMTP)	SMS messages can also be sent via SMTP e-mail (specific providers)
PG5 access	S-Bus PLM / PPP (Ether S-Bus UDP socket)	S-Bus PLM / PPP (Ether S-Bus UDP socket)	S-Bus PLM / PPP (Ether S-Bus UDP socket)	Ether-S-Bus UDP socket; with APN b or c only	Ether S-Bus (UDP socket), fixed IP address or DynDns	For APN b, customer-specific DNS resolution is required
Sending e-mails	PPP (SMTP protocol)	PPP (SMTP protocol)	PPP (SMTP protocol)	PPP (SMTP protocol) Possible with all APNs	Via Ethernet TCP/IP (e.g. SMTP)	With some providers, e-mails (<160 chars.) can also be sent via SMS (without PPP)
WEB server access (web server from WAC)	S-Bus (Webconnect) / PPP (HTTP direct)	S-Bus (Webconnect) / PPP (HTTP direct)	S-Bus (Webconnect) / PPP (HTTP direct)	Possible with APN b or c only	Via Ethernet TCP/IP PCD must use fixed IP address or DynDns	It is advisable to provide IMasterSaiaXX.jar with Webconnect
FTP server access from WAC	With PPP only	With PPP only	With PPP only	PPP, possible with APN b or c only	PPP, possible with APN b or c only	For APN b, customer-specific DNS resolution is required

Application (function)	PSTN	ISDN	GSM	GPRS (with PPP only)	xDSL (broadband router), additional hardware	Further comments
Open Data Mode (WAC is master)	PPP (Ether S-Bus UDP socket)	PPP (Ether S-Bus UDP socket)	PPP (Ether S-Bus UDP socket)	Possible with all APNs	Via Ethernet TCP/IP	The communication partner must have a fixed address (or a DNS name)
Open Data Mode (WAC is slave)	PPP (Ether S-Bus UDP socket)	PPP (Ether S-Bus UDP socket)	PPP (Ether S-Bus UDP socket)	Possible with APN b or c only	Via Ethernet TCP/IP PCD must have a fixed IP address (DynDns)	For APN b, customer-specific DNS resolution is required
Modbus (WAC is master)	PPP only (Modbus TCP) Serial Modbus on modem not supported	PPP only (Modbus TCP) Serial Modbus on modem not supported	PPP only (Modbus TCP) Serial Modbus on modem not supported	Possible with all APNs	Via Ethernet TCP/IP	The communication partner must have a fixed address (or a DNS name)
Modbus (WAC is slave)	PPP only (Modbus TCP) Serial Modbus on modem not supported	PPP only (Modbus TCP) Serial Modbus on modem not supported	PPP only (Modbus TCP) Serial Modbus on modem not supported	PPP, possible with APN b or c only	Via Ethernet TCP/IP PCD must have a fixed IP address (DynDns)	For APN b, customer-specific DNS resolution is required
PCD – PCD communication	S-Bus or PPP (Ether S-Bus)	S-Bus or PPP (Ether S-Bus)	S-Bus or PPP (Ether S-Bus)	At least 1 PCD must have APN b or c	Ether S-Bus (UDP socket) At least 1 PCD must have a fixed IP address (DynDns)	For APN b, customer-specific DNS resolution is required

Application (function)	PSTN	ISDN	GSM	GPRS (with PPP only)	xDSL (broadband router), additional hardware	Further comments
SNMP Agent (WAC is slave)	With PPP only	With PPP only	With PPP only	PPP, possible with APN b or c only	PPP, possible with APN b or c only	For APN b, customer-specific DNS resolution is required
SNMP Traps (WAC is master)	With PPP only	With PPP only	With PPP only	Possible with all APNs	Via Ethernet TCP/IP PCD must use fixed IP address or DynDns	The communication partner must have a fixed address (or a DNS name)
S-Bus to control system / OPC server (WAC is master, control system is slave)	S-Bus or PPP	S-Bus or PPP	S-Bus or PPP	Ether S-Bus UDP socket. Available with all APNs	Ether S-Bus (UDP socket).	Control system must have a fixed address (or a DNS name)
S-Bus to control system / OPC server (control system is master, WAC is slave)	S-Bus or PPP	S-Bus or PPP	S-Bus or PPP	Possible with APN b or c only	Ether S-Bus (UDP socket). fixed IP address or DynDns	For APN b, customer-specific DNS resolution is required
SNTP (time synchronisation)	With PPP only	With PPP only	With PPP only	Possible with all APNs	Via Ethernet TCP/IP	

4.2 Restrictions / unsupported services

A DynDns client would be a useful aid when using APN b (dynamic public addresses). Unfortunately, this protocol is not currently supported. There are however 2 ways of accessing stations that change their IP addresses dynamically. If you have a server that can be reached via a fixed address (this may be a control system or any server on the Internet), you can use a separate protocol with which the controls communicate their current addresses. There are also scripts that can be used with a mail server to receive e-mails from the controls and pass on the current addresses to the DynDns server.

As of now, the PCD3.WAC does not have a protocol that allows it to establish a virtual channel with authentication and encryption over the Internet. (Examples: L2TP, GRE, VPN with IPSEC, PPTP, SSH)

Nor is there any protocol available to allow secure authentication to be performed and files to be transferred (e.g. Secure FTP)

All the available protocols, as used on the HTTP server, FTP server or the SMTP client, have no "CHAP" authentication; login and password are transmitted as plain text, which may constitute a security risk.

The WAC does not currently provide any NAT routing function. With the Enable Port Forwarding function (EnaIPFW = 1), you can however access devices that have a static address within the LAN. You can use this function with GSM, PSTN or ISDN dialup connections to reach other devices on the LAN. This provides the function of a Remote Access Router for incoming connections. However, it is not possible to use this function to give other network devices (e.g. cameras) Internet access via the network layer, i.e. without any specific support from a user program on the PCD.

The Voice service is not supported by the WAC. There is no way of using the voice functionality of the integrated modem. As NAT routing is not supported, you cannot use Voice over IP (VoIP) devices either.

5 Subscriptions, providers, test subscriptions for GPRS operation

5.1 SWISSCOM products

GPRS functions (IP, PPP)						
General name	Data only card	Prepaid SIM card	SIM card monthly contract	Service APN b	Service APN c	Remarks
Name of Swisscom product	For data only data basic (data flex)	Prepaid Natel Easy	Normal phone subs. Natel swiss Liberty,	Data Basic CAA service	Data Basic CNA service	
Sending e-mails	yes	yes	yes	yes	yes	
Outgoing IP protocols (e.g. Ether S-Bus)	yes	yes	yes	yes	yes	
Incoming IP protocols (HTTP, FTP)	no	no	no	yes *	yes	* No fixed IP address

Further information on SWISSCOM products

APN a:

Public Internet Access (Data basic, Natel Easy, Natel swiss Liberty)

Only outgoing connections supported. The RTUs cannot be accessed from the Internet.

APN b:

CAA Corporate Application Access

You can order this service for € 4 on top of the monthly costs (€ 7). You will be given a public Internet address. The address changes every time the connection is re-established. As the PCD does not provide any DynDns service, you need to find another way of communicating the current IP address (e.g. e-mail, Ether S-Bus)

APN c:

CNA Corporate Network Access

This service sets up a VPN network between the WAC and a router with IPSEC (function). The router must be connected to the customer's network. A connection with a fixed IP address (e.g. ADSL) must be present on the corporate LAN. The prices of these services are high.

Swisscom quoted us the following prices: CHF 2300 installation costs, monthly costs CHF 690 + x times CHF 10 (where x is the number of SIM cards). The price of data transfer has to be paid separately (e.g. CHF 49 for 1.5 GB / month). For installations with fewer than 50 devices, this price does not look attractive. If the customer does not want to maintain any network infrastructure of its own, Swisscom has another solution, IPSS (installation costs: CHF 5300, monthly costs: CHF 1430)

5.2 Experience with other operators: T-Mobile

The SIM card that we received from T-Mobile has similar features to the SIM card from Swisscom. The possibility of using an alternative APN with a public (variable) IP address was provided following individual discussions with the operator. With a normal data subscription from T-Mobile, you can then use 2 APNs. One APN represents the Public Internet Access. With this, you can only use the facility for outgoing data communication (e.g. sending e-mails). Another APN provides the same functionality as Swisscom's CAA. We tested the following applications: HTTP and FTP access. The PING command for diagnostics also works.

5.3 Internal test (of basic function)

If you have a SIM card that supports GPRS, you can already cover useful basic functions (for an initial test, you can often use the SIM card from your mobile phone). With this sort of card, you can already perform a few tests. You can check whether communication can be established without any problems (PPP connection setup).

If you do not want to run a complete web demo but only want to use basic functions such as sending e-mails (outgoing connections in general), you do not generally need a specific subscription. The Data Basic functionality from Swisscom (Public Internet Access) is sufficient here.

You need to establish whether network elements (firewalls) in the operator's system block certain protocols (as a rule, e-mail always works, as this service is also needed by many PC users; however, an operator may have blocked UDP port 5050, which is needed for Ether S-Bus).



Standard e-mail client



Empfänger:	MAINTENANCE@SAIA.BURGESS.COM
Betreff:	PROBLEM IN ANLAGE 08.15! (Status=\$!0016-\$!0024)
Beispiel:	<pre>PROBLEM IN ANLAGE 08.15 Dies ist eine Demo-E-Mail, gesendet von einer Saia PCD per SMTP! Diese Nachricht kann auch eingebettete SPS-Daten enthalten, z.B. - Datum/Uhrzeit beim Versand: ??-??-?? ??:??:?? - Zustand von 8 Eingängen: ????????</pre>

Most operators offer new subscriptions without any monthly fixed costs (e.g. Swisscom: Dataflex). The charges with these subscriptions are often based on time not volume (e.g. € 3/hour). These cards could also be interesting for testing or demo purposes. GPRS operation is too expensive for continuous use.

5.4 WAA demos (extended functional tests)

If you want to present the PCD.WAC at a trade fair or similar event, it is an advantage to be able to show that you can also access the PCD or the data (registers, flags etc.) from outside. For this purpose, you need a public IP address. Depending on the application, a VPN or a closed network within the operator may be suitable. The majority of GSM operators only provide permanent IP addresses where a contract for a large number of communication devices (e.g. 50) has been signed. For testing and demo projects, the ideal thing is to take out a fixed-term subscription with a permanent public address.

As a minimum requirement, you need an additional service with a variable public IP address. This allows you to use the web project, the FTP server and PG5 access. If you do not have this, you can only demonstrate the functions for sending e-mails and SMS messages. If you are prepared to make the effort, you can create a project to send data to an Internet server (by e-mail or Ether S-Bus) and then show that the information on the server has changed. At present, we cannot offer a ready-made solution that can be deployed without a lot of effort.

Experience at SAIA in Murten:

We subscribed to 2 data SIM cards from Swisscom (€ 7 / month). Both cards have the CAA service installed (public variable IP address, € 3 / month). Following discussions with the operator, we also have an additional service on these cards that enables us to use a test APN which provides permanent public addresses. In fixed IP operation, you use a special infrastructure from Swisscom. The special test APN has fewer security features than the live APN (no VPN, no redundancy). The operators (e.g. Swisscom) offer suppliers of M2M solutions such additional functions where they believe that new customers can be acquired in the future (it may also be possible to negotiate a limited testing period).

5.5 Subscriptions for customer projects

When you look for a communication solution for end-customers, you get the impression that GSM operators have no product to meet the needs of typical M2M applications. There is a “gap in the market” for installations where the number of devices is less than about 50.

If you use RTUs and want to be able to access every device via GPRS individually and without restriction, you currently have only one option for setting up a CNA (Corporate Network Access) – with Swisscom at least.

The operators only actually recommend services like CAN without any restrictions, i.e. you create a VPN network using the operator’s infrastructure. For installations with a larger number of RTUs, you should also consider whether a special software implementation within the control system can allow you to work with the simplest and cheapest subscription that provides just one private IP address and supports bi-directional communication with a special protocol between the control system and the RTU.

For a systems house or an OEM that needs to supply installation in several countries, it is certainly preferable not to be dependent on specific services from the operators. There is then a good chance that the solution will work in the maximum number of countries.

6 Annex

6.1.1 GPRS operator information

This section contains details of how to configure the GPRS APN parameters for various providers. The following link provides information on the major telecommunications operators in each country: http://www.nav4all.com/site2/www.nav4all.com/ger/gprs_listcountries.php

An extract is given over the next few pages.

Note: There is no guarantee that these details are correct. In case of doubt, it is always better to obtain the latest information directly from the relevant operator. You should find out the exact communication tariffs beforehand. If, for example, you have a contract under which you have to pay EUR 0.50 per 10 kB, you will incur costs of EUR 250 to transfer just Austria:

Operator: - Connect Austria
GPRS APN: - web.one.at
Username: - {user specific}
Password: - {user specific}
DNS: - 194.24.128.100, 194.24.128.102

Operator: - Max Online Metro
GPRS APN: - gprsmetro
Username: - GPRS
Password: - {blank}
DNS: - 213.162.64.1, 213.162.64.2

Operator: - Max Online
GPRS APN: - gprsinternet
Username: - GPRS
Password: - {blank}
DNS: - 213.162.64.1, 213.162.64.2

Operator: - Mobilkom A1
GPRS APN: - A1.net
Username: - gprs@a1plus.at
Password: - {blank}
DNS: - 194.48.124.200, 194.48.139.254

Operator: - Max Online Business
GPRS APN: - business.gprsinternet
Username: - GPRS
Password: - {blank}
DNS: - 213.162.64.1, 213.162.64.2

Operator: - Tele.Ring
GPRS APN: - web
Username: - web@telering.at
Password: - web
DNS: - 212.95.31.11, 212.95.31.35

Belgium

Operator: - Proximus
GPRS APN: - internet.proximus.be
Username: - {blank}
Password: - {blank}
DNS: - 195.238.2.21, 195.238.2.22

Operator: - Mobistar
GPRS APN: - web.pro.be
Username: - mobistar
Password: - mobistar
DNS: - 212.65.63.10, 212.65.63.145

Czech Republic:

Operator: - Cesky Mobil (contract)
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 212.67.64.2

Operator: - Cesky Mobil (prepaid)
GPRS APN: - cinternet
Username: - {blank}
Password: - {blank}
DNS: - 212.67.64.2

Operator: - Eurotel (contract)
GPRS APN: - internet
Username: - {blank}

Password: - {blank}
DNS: - 160.218.10.200, 160.218.43.200

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Operator: - Eurotel Go
GPRS APN: - gointernet
Username: - {blank}

Password: - {blank}
DNS: - 160.218.10.201, 194.228.2.1

Operator: - Oscar (contract)
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 217.77.161.130, 217.77.161.131

Operator: - Oscar (Oskarta)
GPRS APN: - ointernet
Username: - {blank}
Password: - {blank}
DNS: - 217.77.161.130, 217.77.161.131

Operator: - T-Mobile
GPRS APN: - internet.t-mobile.cz
Username: - {blank}
Password: - {blank}
DNS: - 62.141.0.1, 62.141.0.2

France

Operator: - Bouygues
GPRS APN: - ebouygtel.com
Username: - {blank}
Password: - {blank}
DNS: - 62.201.129.99, 62.201.159.99

Operator: - SFR
GPRS APN: - websfr
Username: - {blank}
Password: - {blank}
DNS: - 172.20.2.10, 194.6.128.4

Operator: - Bouygues (B2Bouygtel)
GPRS APN: - b2bouygtel.com
Username: - {blank}
Password: - {blank}
DNS: - 62.201.129.99

Operator: - Orange
GPRS APN: - orange.fr
Username: - orange
Password: - orange
DNS: - 194.51.3.56, 194.51.3.76

Germany

Operator: - D2 Vodafone (NAT IP)
GPRS APN: - web.vodafone.de
Username: - {any}
Password: - {any}
DNS: - 139.7.30.125, 139.7.30.126

Operator: - D1 T-Mobile (NAT IP)
GPRS APN: - internet.t-mobile
Username: - {any}
Password: - {any}
DNS: - 193.254.160.1, 193.254.160.2

Operator: - E-Plus (NAT IP)
GPRS APN: - internet.eplus.de
Username: - eplus
Password: - gprs
DNS: - 212.23.97.2, 212.23.97.3

Operator: - O2 (Viag Interkom, (NAT IP)
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 195.182.96.28, 195.182.96.61

Greece

Operator: - Telestet
GPRS APN: - gnet.b-online.gr
Username: - {your phone number}
Password: - 24680
DNS: - 212.152.79.19, 212.152.79.20

Operator: - Vodafone GR
GPRS APN: - internet.vodafone.gr
Username: - {blank}
Password: - {blank}
DNS: - 213.249.17.10, 213.249.17.11

Operator: - Cosmote
GPRS APN: - internet

Username: - {blank}
Password: - {blank}
DNS: - 195.167.065.194

Hungary

Operator: - Pannon (contract)
GPRS APN: - net
Username: - {blank}
Password: - {blank}
DNS: - 193.225.155.254, 194.149.0.157

Operator: - Vodafone (prepaid)
GPRS APN: - vitamax.snet.internet.net
Username: - {blank}
Password: - {blank}
DNS: - 80.244.97.30, 80.244.96.1

Operator: - Pannon (flat rate)
GPRS APN: - netx
Username: - {blank}
Password: - {blank}
DNS: - 193.225.155.254, 194.149.0.157

Operator: - Vodafone (contract)
GPRS APN: - standardnet.vodafone.hu
Username: - {blank}
Password: - {blank}
DNS: - 80.244.97.30, 80.244.96.1

Operator: - Westel (contract)
GPRS APN: - internet
Username: - {user specific}
Password: - {user specific}
DNS: - 194.176.224.3, 194.176.224.1

Israel

Operator: - MTC-Vodafone
GPRS APN: - apn01
Username: - {blank}
Password: - {blank}
DNS: - 10.10.10.30

Italy

Operator: - BLU Contratto
GPRS APN: - INTERNET
Username: - {blank}
Password: - {blank}
DNS: - 212.17.192.49, 212.17.192.49

Operator: - Vodafone Omnitel
GPRS APN: - web.omnitel.it
Username: - {blank}
Password: - {blank}
DNS: - 194.185.97.134

Operator: - BLU Prepagata
GPRS APN: - PINTERNET
Username: - {blank}
Password: - {blank}
DNS: - 212.17.192.49, 212.17.192.49

Operator: - TIM
GPRS APN: - uni.tim.it
Username: - {blank}
Password: - {blank}
DNS: - 213.230.155.94, 213.230.130.2

Operator: - Wind
GPRS APN: - internet.wind
Username: - {blank}
Password: - {blank}
DNS: - 212.245.255.2

Luxembourg

Operator: - LUXGSM
GPRS APN: - web.pt.lu
Username: - {blank}
Password: - {blank}
DNS: - 194.154.192.101, 194.154.192.102

Netherlands

Operator: - KPN Mobile
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 62.133.126.28, 62.133.126.29

Operator: - T-Mobile
GPRS APN: - internet
Username: - t-mobile
Password: - t-mobile
DNS: - 193.79.237.39, 193.79.242.39

Norway

Operator: - Netcom
GPRS APN: - internet.netcom.no
Username: - {blank}
Password: - {blank}
DNS: - 212.45.118.43, 212.45.118.44

Operator: - Telenor Mobil
GPRS APN: -
Username: - {blank}
Password: - {blank}
DNS: - 212.17.131.3, 212.17.130.194

Poland

Operator: - ERA
GPRS APN: - erainternet
Username: - erainternet
Password: - erainternet
DNS: - 213.158.194.1

Operator: - Idea
GPRS APN: - www.idea.pl
Username: - idea
Password: - idea
DNS: - 194.9.223.79, 194.204.159.1

Operator: - Plus GSM/Polkomtel
GPRS APN: - www.plusgsm.pl
Username: - {blank}
Password: - {blank}
DNS: - 212.2.96.51, 212.2.96.52

Portugal

Operator: - Optimus
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 194.79.69.129, 194.79.69.222

Operator: - TMN
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 194.65.3.20, 194.65.3.21

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Operator: - Vodafone (Telcel)
GPRS APN: - internet.vodafone.pt
Username: - {blank}
Password: - {blank}
DNS: - 212.18.160.133, 212.18.160.134

Russia

Operator: - BeeLine
GPRS APN: - internet.beeline.ru
Username: - {blank}
Password: - {blank}
DNS: - 194.190.195.66, 194.190.192.34

Operator: - MTS
GPRS APN: - internet.mts.ru
Username: - mts
Password: - mts
DNS: - 213.87.0.1, 213.87.1.1

Spain

Operator: - Amena
GPRS APN: - internet
Username: - CLIENTE
Password: - AMENA
DNS: - 213.143.33.8, 213.143.32.20

Operator: - Telefonica (Movistar)
GPRS APN: - movistar.es
Username: - movistar
Password: - movistar
DNS: - 194.179.001.100, 194.179.001.101

Operator: - Vodafone (Airtel)
GPRS APN: - airtelnet.es
Username: - vodafone
Password: - vodafone
DNS: - 212.73.32.3, 212.73.32.67

Switzerland

Operator: - Swisscom (NAT IP)
GPRS APN: - gprs.swisscom.ch
Username: - {blank}
Password: - {blank}
DNS: - 164.128.36.34, 164.128.76.39

Operator: - Orange (NAT IP)
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 213.55.128.1, 213.55.128.2

Operator: - Swisscom (public IP)
GPRS APN: - corporate.swisscom.ch
Username: - *Profil beim Provider definieren*
Password: - *Profil beim Provider definieren*
DNS: - 164.128.36.34, 164.128.76.39

Operator: - Orange (for M2M, no public IP)
GPRS APN: - m2m
Username: - {blank}
Password: - {blank}
DNS: - 213.55.128.1, 213.55.128.2

Operator: - Sunrise (NAT IP)
GPRS APN: - internet
Username: - internet
Password: - internet
DNS: - 212.35.35.35, 212.35.35.5

Turkey

Operator: - Aria
GPRS APN: - aycell
Username: - {user specific}
Password: - {user specific}
DNS: - 212.156.4.1, 212.156.4.4

Operator: - Turkcell
GPRS APN: - internet
Username: - {blank}
Password: - {blank}
DNS: - 212.252.168.240, 212.252.119.4

UK

Operator: - BT Mobile
GPRS APN: - btmobile.bt.com
Username: - bt
Password: - bt
Gateway IP: - 212.183.137.12

Operator: - Orange UK
GPRS APN: - orangeinternet
Username: - {blank}
Password: - {blank}
Gateway IP: - 192.168.71.35

Operator: - Jersey Telecom
GPRS APN: - pepper
Username: - {blank}
Password: - {blank}
DNS: - 212.9.0.135, 212.9.0.135

Operator: - T-Mobile
GPRS APN: - general.t-mobile.uk
Username: - user
Password: - wap
Gateway IP: - 149.254.1.10

Operator: - O2 UK (contract)
GPRS APN: - wap.o2.co.uk
Username: - o2wap
Password: - password
Gateway IP: - 193.113.200.195

Operator: - Tesco Mobile
GPRS APN: - prepay.tesco-mobile.com
Username: - tescowap
Password: - password
Gateway IP: - 193.113.200.195

Operator: - O2 UK (pre-pay)
GPRS APN: - payandgo.o2.co.uk
Username: - payandgo
Password: - password
Gateway IP: - 193.113.200.195

Operator: - Virgin Mobile
GPRS APN: - goto.virginmobile.uk
Username: - user
Password: - {blank}
Gateway IP: - 193.30.166.3

Operator: - Vodafone (Contract)
GPRS APN: - wap.vodafone.co.uk
Username: - wap
Password: - wap
Gateway IP: - 212.183.137.12

Operator: - Vodafone (pre-pay)
GPRS APN: - pp.vodafone.co.uk
Username: - wap
Password: - wap
Gateway IP: - 212.183.137.12

USA

Operator: - Cingular
GPRS APN: - isp.cingular
Username: - ISPDA@CINGULARGPRS.COM
Password: - CINGULAR1
DNS: - 66.209.10.201, 66.209.10.202

Operator: - T-Mobile (Internet)
GPRS APN: - internet2.voicestream.com
Username: - {blank}
Password: - {blank}
DNS: - 216.155.175.105, 216.155.175.106

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