Pager v2 User Guide

Pager v2 is an application for SMS control and measurement. Application is best used with **Turbo Lite 2**, but is compatible with all products in the **Turbo SIM Toolkit Adapter** family – including the original **Turbo Lite**.

Pager v2 follows on from **version 1** with the inclusion of most of the users' wishes and resolves several problems experienced with original **Pager** application deployment.

Features

- **2+2 opto-isolated inputs/outputs available on Turbo Lite 2**
- **13 digital Turbo Lite compatible inputs/outputs**
- **4 analog inputs (10 bit ADC)**
- **SMS Alarms for both digital and analog inputs; FAX SMS Alarm functionality**
- **Arbitrary independently configurable control and response messages for each port. Seamless integration with other systems.**
- **User rights independently configurable for each port.**
- **Open source, free software.**

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1 Quick Start

The basic setup of the application is very easy and consists of two steps if the opto-isolated inputs (**Out1, Out2, In1, In2**) are used, or three steps if the generic ports (**P1-P13**) are used:

1. If **generic ports P1-P13** are used, the **function** of each port needs to be setup, i.e. to specify if a given port is **digital input or output** – or in the case of **P1-P4, analog input** as well.
2. Setup of **control and response SMS**.
3. Setup of **users and rights** for a given port.

Example of Opto Out1 output configuration

Configuration of control SMS:
Setup **Config->Opto Out1->Messages-> > State** to **Light**
Setup **Config->Opto Out1->Messages-> > On** to **On**
Setup **Config->Opto Out1->Messages-> > Off** to **Off**

Configuration of response SMS:
Setup **Config->Opto Out1->Messages-> < On** to **Light is on**
Setup **Config->Opto Out1->Messages-> < Off** to **Light if off**

Insert your phone number in **Config->Opto Out1->Numbers** (default configuration permits all commands).

By sending SMS with text: **Light**, you get an answer of either **Light is on** or **Light is off** depending on output state. The output state can be controlled with an SMS containing the text: **On** or **Off**.

2 User Interface

Main menu of the application appears as the screen below:

```
State
Config
Version
```

2.1 State

Items under the **State** menu show the current values of labelled ports.

> **Note.** In **version 1** of the **Pager** application, labelling of the ports was mandatory and denoted usage of the given ports. In **version 2** this concept was abandoned and replaced by definition of port-based control messages. Port labelling is used only for displaying overall current state.

2.2 Version

Displays current version of installed **Pager** application.

> **Note.** It is possible to upload the **Pager** application with the help of a data cable and some utilities (**turbo-cable-utils** – available from **www.bladox.com**). This is ideal for uploading with only the data cable (depending on the mobile phone used, the connection can be serial, USB, IrDA or BT) and a phone that supports AT commands.

2.3 Config

In the **Config** sub-menu it is possible to **configure each port, set the polling interval** and also **clear all SMS on SIM card**.

Pager v2 allows users to configure **13 generic ports P1-P13** as **digital I/O –** where **P1-P4** can also be used as **analog inputs**. With **Pager v2** there is now the option to use the 2+2 opto-isolated I/O available on **Turbo Lite 2** and **Turbo Motion 2**.
When **Pager v2** is used with the **Turbo Lite**, **Turbo Motion** or **Turbo Adapter**, opto-isolated ports **Opto Out1, Out2, In1** and **In2** are unused.

> **Poll Interval**
> **Opto Out1**
> **Opto Out2**
> **Opto In1**
> **Opto In2**
> **P1**
> **P2**
> **...**
> **P13**
> **Clear SIM SMS**

2.3.1 Poll Interval

Poll interval specifies how often the inputs are checked. This is particularly important if there is an alarm activated for some inputs. Because Turbo, SIM and mobile phone "sleep" most of the time to conserve power, the phone stops the clocks for the SIM (and subsequently for the Turbo as well). So the inputs are checked periodically during the phones' STATUS APDU (command that phone uses to check state of the SIM card). How often the STATUS APDU is issued can be set in the phone itself – usually between 5-30 seconds. The mobile phone can support only some values and will select the closest supported value.

It is possible to set a **zero** value for the polling interval. In this case the **Pager** application uses a different mechanism. Rather than using STATUS APDU command it uses the SIM Toolkit command MORE TIME and the inputs are checked about 5 times per second.

> **Warning.** Setting a zero value for the poll interval has a dramatic effect on power consumption and should only be used if the phone is connected to a constant power source.

> **Note.** Periodic STATUS APDU is used only if there is no other communication with SIM card, i.e. only after initialization of mobile phone and a period of inactivity (takes about 1-3 minutes depending on mobile phone and SIM card).

2.3.2 Output Configuration

The following description covers the configuration of arbitrary outputs, besides **Opto Out1 and Out2** it also covers **P1-P13**, as they can also be set as outputs.

The basic setting of output is the definition of command and response SMS messages. In **version 1**, the commands: **ON**, **OFF** and **BTN** were predefined and could not be changed. **Version 2** gives the user absolute freedom (the only limitation is usage of default 7 bit SMS alphabet) to define not only "command SMS" (control of values, request for state) but also "response SMS". It is possible to have command SMS: **turn on light in basement** to turn on light #1; **turn on light in garage** to turn on light #2; **lights off** to turn all lights off; and response messages **light in basement is on** or **basement is dark** as

answers for question: **basement**, etc.

Every port can have its own set of command and response messages defined and messages can be the same for different ports, i.e. one command SMS then controls more outputs.

The second step is to configure user rights. These are in the form of mobile phone numbers with permission to control the output of individual ports. This is different to **version 1** where numbers were given global rights to all **Pager** controlled ports regardless. **Version 2** allows for the specification of which mobile numbers have access to which port(s) independently – and it is also possible to have separate user groups.

> **Label**
> **Messages**
> **Numbers**
> **On Level**
> **Value**
> **RESET Value**

2.3.2.1 Label

Labelling of the output – this is not mandatory (different to **version 1**) and used only in **Pager->State** to help identify the item being reported upon, i.e. Garage Light, Air Conditioner, etc.

2.3.2.2 Messages

Sub-menu **Messages** allows for the definition of command and response messages. It is not necessary to define all the commands, only those that will be used are enough.

> **> State**
> **> On**
> **> Off**
> **> Button**
> **< On**
> **< Off**

The '**>**' symbol denotes **incoming – command SMS**; '**<**' symbol denotes **outgoing – response SMS**.

> State
Command to request the current state of given output. Response will be a message defined for states **On/Off** i.e. Garage Light On, Bedroom One is Dark, etc.

> On

Command for turning on the output, i.e. setting the value to "**On Level**".

> Off

Command for turning off the output.

> Button

Commands for brief change of output value – simulates button behaviour. The pulse length is about 500ms (depending on mobile phone used). The length can be modified in the application source code.
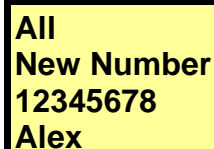
< On

Text of response used if the output is "turned on".

< Off

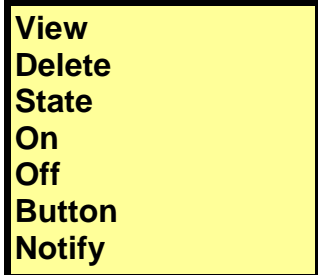Text of response used if the output is "turned off".

2.3.2.3 Numbers

The item: **Numbers** is for specifying users (or groups of users) and their rights based on their mobile number. It is possible to specify that given port can be used by any user and number checking is not used; or only by selected group of users with clearly defined rights. For example some user can only turn on the output but cannot turn it off (i.e. activates siren that can only be deactivated by another user after situation check, etc.).

```
All
New Number
12345678
Alex
```

The item: **All** sets if output can be controlled by everybody or by selected users/user groups only.

The item: **New Number** creates new users – number can be selected from SIM phone book or inserted directly. **12345678** and **Alex** are examples of users. In the case of a number being selected from the phone book, the associated name is automatically used.

User Rights for Output

```
View
Delete
State
On
Off
Button
Notify
```

View shows number itself – useful for checking number if it was selected from the phone book.

Delete is used for removal of the number.

State controls if user can query the current output state – default is **YES**.

On controls right for turning output on – default is **YES**.

Off controls right for turning output off – default is **YES**.

Button controls right for short-time (pulse) status change – default is **YES**.

Notify controls if user is to be informed of an output change. For example, there can be a group of users defined for output "siren" to receive notification SMS when siren has been activated by any user. Default is **YES**.

2.3.2.4 On Level

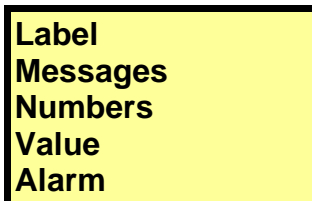Defines electric level of logical value On. Default is 1.

2.3.2.5 Value

Manual control of output value.

2.3.2.6 RESET Value
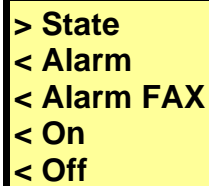
Defines value after mobile phone reset. Default is Off.

2.3.3 Input Configuration

| Label |
| Messages |
| Numbers |
| Value |
| Alarm |

Label is used for labelling of the input; see Labelling of Output.

2.3.3.1 Messages

In sub-menu: **Messages**, command and response SMS are defined.

```
> State
< Alarm
< Alarm FAX
< On
< Off
```

The '**>**' symbol denotes **incoming – command SMS**; '**<**' symbol denotes **outgoing – response SMS**.

> State – control SMS for obtaining current state of the input.

< Alarm – definition of alert SMS.

< Alarm FAX – definition of text for a fax alert message. Although SIM Toolkit technology allows for setting up a call, unfortunately, this operation requires user confirmation – making it unsuitable for remote alerting. Fax alert message is useful for emulating an alarm call with the help of SMS-to-FAX service provided by operator* (mobile carrier). Operator tries to deliver text SMS as fax to requested number and makes a call. For example, message sent as "fax 12345678 water in cellar" sent to service number instructs the operator to deliver fax with text "water in cellar" to number 12345678.
*Service availability and conditions depend on mobile operator used.

< On – text of response state SMS when input value is On.

< Off – text of response state SMS in case input value is Off.

2.3.3.2 Numbers

The **Numbers** sub-menu allows definition of users/groups of users and their rights for a given input. Configuration is similar to output configuration and appears like so:

```
View
Delete
State
Alarm
Alarm FAX
```

The item: **View** shows number itself – useful for checking number if it was selected from the phone book.

Delete is used for removal of the number.

State controls if user can query the current input state – default is **YES**.

Alarm controls if user should receive an alert SMS (in case input is set up as alarm and alarm conditions were satisfied). Default is **YES**.

Alarm FAX – controls if given number should receive FAX alert message. Number has to be the number defined by the operator for their SMS-to-FAX service. Default is **NO**.

2.3.3.3 Value

Shows current input value.

2.3.3.4 Alarm

The item **Alarm** defines if given input triggers alarm. If yes, then a new item for alarm definition is offered - **Level**:

```
Label
Messages
Numbers
Value
Alarm
Level
```

2.3.3.5 Level

Item **Level** defines value (condition) when the alarm will be triggered – **0**, **1** or **Flip-Flop**. In case of **Flip-Flop**, alarm is triggered with every change of the input.

2.3.4 Generic Ports P1-P13 Configuration

Ports **P1-P13** can be arbitrarily defined as digital inputs or outputs; **P1-P4** can also be defined as analog inputs.

Configuration of **P1-P13** appears as the following screen (default setting is input):

```
Label
Messages
Numbers
I/O/ADC
Value
Alarm
```
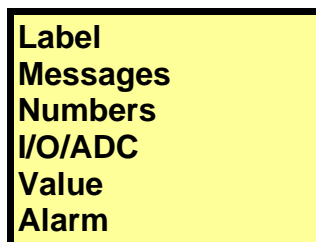
Meaning of **Label**, **Messages**, **Numbers** is the same as for opto-isolated I/O (similarly **Value** and **Alarm** are also the same), however, there is the additional items **I/O** or **I/O/ADC** for ports **P1-P4** respectively.

```
* Input
  Output
  ADC
```

(*) denotes selected function; **ADC** is offered only for **P1-P4**.

2.3.5 Analog Input

Value of the analog input is in the range of 0-1023 and corresponds to voltage 0 - 2,56V (Vref internal reference voltage of A/D converter), i.e. measured voltage is

$$U = 2{,}56*(value/1024) \ [V]$$

Measured voltage can be higher than Vref (value is 1023 then), but has to be lower than Vcc (MCU power voltage).

2.3.5.1 Messages

For analog input there is special response message **< ADC State**. The current ADC value is concatenated to the user defined text, e.g. for defined text **Temperature in cellar is** the message sent is **Temperature in cellar is 312** (where 312 is bit value of ADC).

2.3.5.2 Analog Alarm

Pager also allows for set up of alarms for analog inputs. After the alarm option is selected for an ADC input, there are two new menu items offered: **Threshold** and **Level**.

Threshold defines ADC bit value of the alarm; **Level** determines if the alarm is detected for value **less than or equal to Threshold** or **greater than Threshold**.

2.3.6 Clear SIM SMS

For usage of SMS commands it is necessary that the incoming messages are stored on the SIM card (and not the phones' internal memory) and that there is free space for these text messages.

In case of mobile phones with internal memory for SMS messages, it may be necessary to fill the internal phone memory with, for example, draft to-be-sent messages.

The incoming messages are deleted automatically – so the SIM SMS memory has to be cleared only once.

Suggested steps:
1. Fill the memory for SMS messages in the mobile phone
2. With the **Setup->Clear SIM SMS** item clear all messages stored on the SIM card
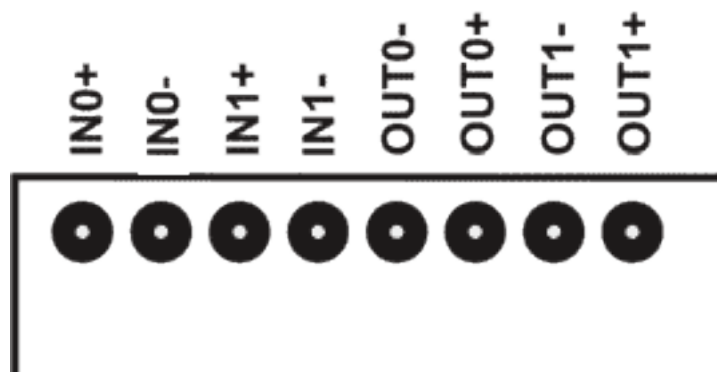
3 Description of Ports
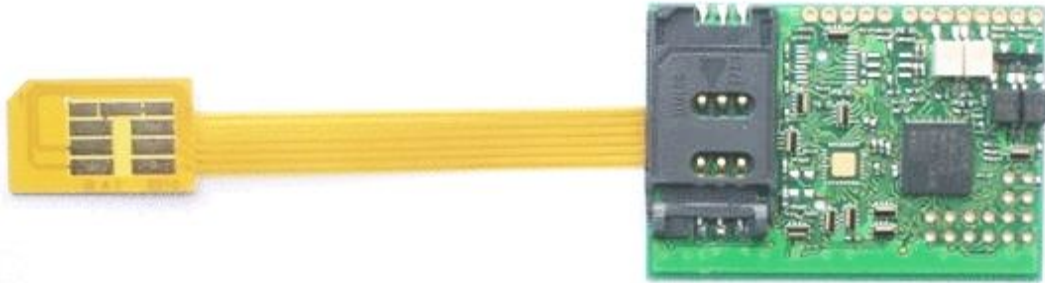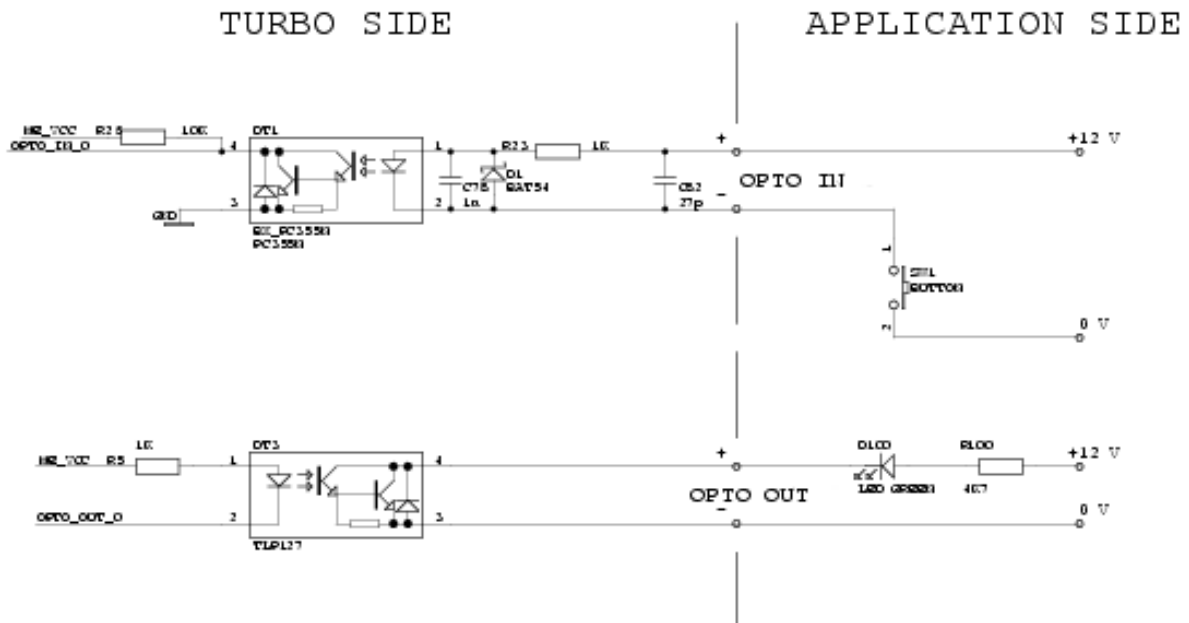

Turbo Lite 2 – components side

Turbo Lite 2 – bottom side

## 3.1 Turbo Lite 2 opto-isolated inputs and outputs

Internal design and example of opto-isolated I/O usage

Input optocouplers used are **PC355N**, Umax 24V.
Output optocouplers user are **TLP127**, Umax 24V, Imax 60mA.

Warning. Maximum current of the output optocouplers is 60mA – depending on usage, it may be necessary to use protection resistor to prevent higher current.

3.2 Turbo Lite compatible ports
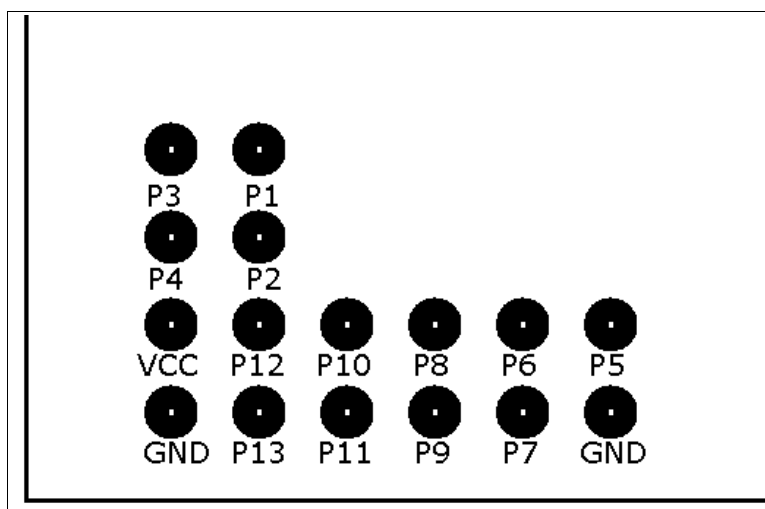
Ports are directly connected to microcontroller Atmega128; datasheet with electrical parameters regarding MCU is available from www.atmel.com

Imax of one port is 10mA, overall current should not be higher than 50mA – limitation depending on mobile phone used.

3.3 Turbo Adapter compatible ports

Pin Description

Turbo Lite Pin	Turbo Pin	ATmega128 Pin	Function
P1	N.A.	PF2	ANALOG I / DIGITAL I/O
P2	N.A.	PF5	ANALOG I / DIGITAL I/O
P3	N.A.	PF3	ANALOG I / DIGITAL I/O
P4	N.A.	PF6	ANALOG I / DIGITAL I/O
P5	27	PG1	DIGITAL I/O
P6	31	PC2	DIGITAL I/O
P7	30	PC1	DIGITAL I/O
P8	35	PC6	DIGITAL I/O
P9	33	PC4	DIGITAL I/O
P10	39	PA7	DIGITAL I/O
P11	36	PC7	DIGITAL I/O
P12	42	PA4	DIGITAL I/O
P13	40	PA6	DIGITAL I/O