XLN-t bvba
Hoogstraat 52
B 2580 Putte-Beerzel
Belgie - Belgium

tel : + 32 (0) 15 24 92 43
fax : + 32 (0) 15 25 10 58
HRM 67730
BTW BE 423 212 087
BANK 733-2011497-38

BDX104 T1000

Manual

V00.03.000002

Software GSM V01.03.000002

Software IOProcessor V01.03

Revisions

V00.03.000002

- Added call in possibility for outputs 1-4 when called from phonenumber on index n1 to n9

V00.03.000001

- Added version information to .S reply
- Added signal strength and debug counters to power-up message

V00.02.000001

- Phonebook index 93 changed to “Power fail activation” time (was “Ignore inputs on power fail”)
- Phonebook index 94 changed to “Ignore inputs on power fail” (was reserved)
- Input request added
- Output handling/request added
- Configuration change/request added
- Status request added
- Battery low voltage detection added
- Power fail phone numbers extended to 8
- Input macro’s added
- Pin code change added

Introduction

The BDX104 T1000 Alarm Transmitter Unit is intended to be used for sending SMS messages when a input is triggered and/or to change outputs with a SMS. All configuration information is stored in the phonebook of the SIM, so it can be changed with a normal GSM phone or with software and a SIM card writer.

The Alarm Transmitter can be powered by a 12V DC power supply or a 230V AC power supply. There is also a battery input so that the Alarm Transmitter runs on batteries when the normal power supply fails.

This version will use received SMS message to confirm a transmitted message and/or to execute the received message. The SMS message can contain fields that indicate a action that must be performed. This makes it possible to change the configuration, read the inputs, set the output and more with a SMS message.

This document is written for the first Alarm Transmitter prototype. All features present in this document are also present in the prototype. The features of the production model can be different from this prototype.

This manual can be difficult to read because of the many options. Read also the application notes that describe the use of the BDX104 T1000 in some specific applications. They are a lot easier to read. Compare the information in the application note with the information in this manual to get a better understanding of the options. Take the next page out of the manual (or make a copy) and place it next to the manual, so you can always look at the table while reading the manual.

Configuration table

All the parameters that are used to configure the unit are stored in the phonebook of the SIM card. The configuration uses indexes 1 to 99. The following table gives a overview.

Index	Text field		Phone number field
01	Location text	(max. 16 characters)	Startup
02	Battery text	(max. 16 characters)	Global output
03	Monitoring on/off	(0 or 1)	Monitoring
04	Debugging on/off	(0 or 1)	Configuration
05	Normal battery check time	(0-2880 minutes)	Battery
06	Power fail battery check time	(0-2880 minutes)	0
07	Battery low voltage threshold	(0-100 in 0.1V)	0
08	Call in 1 macro	(max. 16 characters)	Call in 1
09	Call in 2 macro	(max. 16 characters)	Call in 2
n0	Activate macro, input n	(max. 16 characters)	Log, input n
n1	Input text, input n	(max. 16 characters)	Number 1, input n
n2	Confirm timeout, input n	(0-60 minutes)	Number 2, input n
n3	Required activation time, input n	(0-3600sec)	Number 3, input n
n4	Inverted, input n	(0 or 1)	Number 4, input n
n5	Send deactivate message, input n	(0 or 1)	Number 5, input n
n6	Deactivate macro, input n	(max. 16 characters)	Number 6, input n
n7	Activation time, output n	(0-36000 in 0.1sec)	Number 7, input n
n8	Inverted, output n	(0 or 1)	Number 8, input n
n9	Security level, output n	(0-255)	Number, output n
90	Macro, power fail		Log, power fail
91	Power fail text, power fail	(max. 16 characters)	Number 1, power fail
92	Confirm timeout, power fail	(0-60 minutes)	Number 2, power fail
93	Activation time, power fail	(0-86400 sec)	Number 3, power fail
94	Ignore inputs on power fail	(0 or 1)	Number 4, power fail
95	Send power recovery message	(0 or 1)	Number 5, power fail
96			Number 6, power fail
97			Number 7, power fail
98			Number 8, power fail
99			Macro, power fail

n : number between 1 and 8

Place a 0 in the phone number field to indicate a empty field.

Place nothing or 0 in the text field to indicate a empty field.

SIM and PIN code

The standard PIN code of the BDX104 T1000 is 5253. So the PIN code of the SIM card must be changed to this pin or disabled. The PIN code of the BDX104 T1000 can be changed with a SMS message. Before the SMS message can be received the BDX104 T1000 must be registered to a network, so it must know the pin code of the SIM card. So follow the next procedure to setup a custom PIN code:

- Initialize with a normal GSM phone the PIN code of the SIM card to 5253 or disable
- Place this SIM in the BDX104 T1000
- Power up the BDX104 T1000 and wait until the red led is flashing
- Send the following SMS message to the BDX104 T1000

  `.P`**`imei`**`,A:`**`pin`**`,B:`**`pin`**

  Change **pin** to the wanted pin (4 digits) and **imei** to the last four digits of the IMEI number of the BDX104 T1000 (see **IMEI number** on page 34).

  Example : `.P6434,A:1234,B:1234`

- Wait until you receive a SMS.
- Check the message, must be

  `.P,OK`

  When the message is

  `.P,BAD`

  The pin code is not changed, check the SMS message that you transmitted, both pins must be the same.

  When the message is

.P,ERR

The pin code can't be written to the BDX104 memory. This is a hardware or software bug. The default pin code will be used.

When the message is

.P

The pin code is not changed, check the SMS message that you transmitted, make sure all comma's and letters are in place and that the IMEI number is correct.

- Power off the BDX104 T1000
- Remove the SIM
- Place SIM in normal GSM phone and change the PIN code to the same that you used in the SMS message.
- Place the SIM back in the BDX104 T1000
- Power up
- Wait until red led is flashing

The BDX104 will now use the received PIN code to initialize the SIM.

The phonebook of the SIM card must be initialized before it is placed in the unit. This can be done with a regular GSM phone (by placing the SIM in that phone) or with a PC, phonebook software and SIM writer hardware. If you want to setup the phonebook with SMS message, you can use a SIM with empty phonebook.

Make sure that the power is disabled before changing the SIM card, to prevent damage of the SIM.

Configuration

The configuration of the Alarm transmitter is stored in the phonebook, see **Configuration table** on page **4**.

The phonebook of the SIM card can be initialized before it is placed in the unit or it can be initialized by sending SMS messages.

Initialize phonebook with PC

This is the easiest way to put the configuration in the phonebook. Use phonebook software to setup the configuration. Normally you can easily change the text and phone number fields. When all fields are correct you can write the fields to the SIM with SIM writer hardware.

Now you put the SIM in the Alarm transmitted and power up.

Initialize phonebook with GSM

Depending on the GSM this can be easy or difficult.

When the GSM has the option to give the phonebook index this is very easy. Create the phonebook entry, text field and phone number field and store on the correct index.

When the GSM doesn't have the option to choose the phonebook index, the process is a little bit more difficult.

- First remove all entries from the phonebook.
- Add entry for phonebook index 1
- Add entry for phonebook index 2
- Repeat for each phonebook index (99 in total)

Some GSM don't allow phonebook entries with the same text field. This means, for example, that if you place 1 in the text field of one phonebook entry, you can't place 1 in another. When this is the case for your GSM you can't use it to setup the phonebook. (Except when you don't need text fields with the same text)

Initialize phonebook with SMS messages

When you place a SIM card (can be with empty phonebook) in the Alarm transmitter and power up, you can send SMS messages to change the phonebook entries.

The maximum length of the SMS message depends on the SIM card but no more than 160 characters are accepted by the software. You can always send two or more SMS message to change the configuration.

You must know the IMEI number of the GSM because it must be included in the SMS.

Startup

When power is applied to the unit the GSM module is powered up and led 1 (green) will start flashing.

The GSM module software will try to register on the network. As long as the GSM isn't registered, led 3 (yellow) will be on. From the moment the GSM is registered, the led will start flashing. When the PIN code of the SIM is wrong, the phone will try 3 times to set the pin, but this will fail. Now the GSM module can't register on the network and led 3 (yellow) will stay on. The software will wait forever (resetting every 10 minutes). The SIM card must be reactivated with the PUK code before it is again useful.

When the GSM is registered on the network, the GSM will read the configuration from the phonebook. This can take a few minutes. During this time led 2 (red) is off.

When the configuration is read, the software will check of it must transmit a Startup message. This is the case when the phone number field on index 01 isn't zero. When a phone number is present on index 01, the following SMS message is transmitted to that number:

`.P,1:Powerup;`***`Location text`***`;ss;nt;df;ndr`

The ***Location text*** is the contents of the text field on index 01. This will be added to all transmitted message. This can be used to indicate the location of the unit (for example: Main building). The text field must contain less than 16 characters, but some SIM cards only support text fields of 14 characters.

The **ss** field indicates the signal strength. The signal strength is a value between 0 and 31. The lower the value, the weaker the signal. The value can also be 99, indicating that the signal strength is unknown.

The **nt** field indicates the number of times the GSM is reset by the IOProcessor. The IOProcesser will reset the GSM when there is no longer communication between the GSM and the IOProcessor. This can happen when the GSM locks up. In a power-up message after a main power cycle this field will be 0. In a power-up message that is generated because the IOProcessor has reset the GSM, this value will be more than 0.

The **df** field is a flag that is set to 1 when the IOProcessor powers up. When the GSM reads this flag (during the creation of the power-on message), the IOProcessor will return the current value and then the flag is reset to zero. In a power-up message after a main power cycle this field will be 1. In a power-up message that is generated because of a software reset this value will be 0.

The **ndr** field indicates the number of times the GSM has read the diagnose fields (nt, df, ndr) from the IOProcessor. When the fields are read (during the creation of the power-on message), the IOProcessor will return the current value and then increment the value with 1. In a power-up message after a main power cycle this field will be 0. In a power-up message that is generated because the GSM has reset itself, this value will be more than 0.

Field	**= 0**	**> 0**
nt	Mains power cycle	IOProcessor has reset GSM, value indicates number of resets
df	GSM is reset at least once without a main power cycle.	Mains power cycle
ndr	Mains power cycle	GSM has reset itself, value indicates number of times minus 1 a power-up message is created

So after a mains power cycle the message will be:

`.P,1:Powerup;`***`Location text`***`;ss;0;1;0`

When the GSM module is initialized and there is no action busy, led 2 (red) will start flashing with on and off time of about 2 seconds.

Monitoring and debugging

Monitoring

The software has a monitoring feature that can be helpful to track problems. This feature must be used with care because it slows down the software and will transmit a lot of SMS messages. Use it only to find difficult problems.

To enable the feature there must be a phone number present on index 03 **AND** the text field on that index must contain 1. The phone number is used to send the monitor SMS messages.

When monitoring is enabled, each transmitted and received SMS message is also transmitted to the monitoring phone number. The message will have the following format:

`.M`***`Normal message`***`;`***`Dirirection`***`;`***`Phone number`***

The ***Normal message*** is the message that is transmitted or received. The ***Direction*** is To or From. It is To when the message is transmitted and From when the message is received. The ***Phone number*** is the number where to the message is transmitted to, or received from.

When a input is activated there is also a message transmitted before any other message is transmitted. This message doesn't contain a phone number but **Monitor** or **Monitor+Debug,** indicating that the message is only send to the monitor phone number.

When a input is deactivated, and is completely handled, a deactivate message transmitted.

This also applies to the power fail detection.

Debugging

The debugging feature can be enabled by placing 1 in the text field on index 04. When the text fields contains 0, the debugging is disabled.

When debugging is enabled, the GSM will transmit all monitoring message (even when monitoring is disabled) to a terminal connected on J14. There must be a jumper between pin 5 and 6 on JP4. This can be useful to see all message but without sending each time a SMS message.

You must use the BDX103 TTL-RS232 to convert the signals on J14 to RS232 signals.

Inputs

The unit has 8 inputs that can be individually configured. There is a option to debounce the input, to invert the input, to wait for confirmation and to log the actions.

The inputs must be connected to the common GND with a dry contact to activated (deactivated when inverted) the input.

Index numbering

The inputs are numbered from 1 to 8, that number is called **n** in this text. So for input 5, **n** is 5. Each input can be configured with 9 places in the phonebook, from **n**0 to **n**8. So for input 5, this is 50 to 58. This format is used in the following text.

Invert

The text field on index **n**4 indicates of the input must be inverted. When the field contains 1, the input is inverted.

Normal	The input must be connected to GND to activate the input.
Inverted	The input must be disconnected to activate the input.

Required activation time

The text field on index **n**3, that can be between 0 and 3600 seconds, indicates how long the input must be active, before it is processed. When the input is deactivated before the required activation time is passed, the activation is ignored. This can be used to debounce a input.

When the unit is busy (example sending a SMS for another input or waiting for confirmation) the activation is stored in memory when the input is activated longer than the activation time. When the unit is no longer busy it will read the memory, find the input activated and handle

the input. This means that there can be a long time between the activation of the input and the sending of a activation SMS. The module will handle each input one by one, so when you activate two inputs one the same moment, one input will be handled before the other, but all inputs will be handled.

Confirm timeout = 0

The inputs are handled in two different modes, depending on the confirm timeout, located in text field **n**2. When the field contains 0, the timeout is 0. This means that there is no confirmation needed.

When a input is active longer than the required activation time, the unit will transmit a SMS message to each phone number present on index **n**1 to **n**8. It will not send a SMS message when the phone number field contains a 0 or is empty. The message will have the following format:

`.I,n:Active;`***`Location text;Input text`***

The **n** is the input number. The ***Location text*** is the contents of the text field on index 01. The ***Input text*** is the contents of the text field on index **n**1. This can be used to name the different inputs on the same location.

When the log phone number, located on index **n**0, is not 0, then a message is also transmitted to this phone number, after sending the SMS messages to the normal phone numbers. This message will have the same format.

When the input is deactivated, the unit can also transmit a message to all the phone numbers. This feature can be activated by placing 1 in the text field on index **n**5. The unit will send the following message to the phone numbers on index **n**1 to **n**8 and to **n**0 (in this order).

`.I,n:Idle;`***`Location text;Input text`***

Confirm timeout = 1…60

When the confirm timeout is between 1 and 60 minutes, the input change must be confirmed.

When a input is active longer than the required activation time, the unit will transmit a SMS message to first phone number present on index **n**1 to **n**8. It will not send a SMS message when the phone number field contains a 0. The message will have the following format:

`.I,`**`n`**`:Active;Confirm;`***`Location text;Input text`***

The **n** is the input number. The ***Location text*** is the contents of the text field on index 01. The ***Input text*** is the contents of the text field on index **n**1. This can be used to name the different inputs on the same location. The Confirm indicates that the SMS message must be confirmed. This can only be done by the GSM phone that received the message. Use this phone to send a SMS message (can be a empty message), or to call the unit. When the unit detects ringing from the correct phone number it will wait 10 seconds and then hang-up. The confirmation was successful. When the hang-up is immediately, the confirmation isn't accepted (wrong phone number or to late).

The unit will wait as long as the confirm timeout for the confirmation. When a confirmation is received during this time, no other SMS message (except to the log phone number) is send.

When no confirmation is received, a SMS message is send to the next phone number that is present in the phone book, and the procedure is repeated.

When the log phone number, located on index **n**0, is not 0, then a message is also transmitted to this phone number, after confirmation:

`.I,`**`n`**`:Active;Confirmed;`**`x`**`;`***`Location text;Input text`***

The **x** is the phone number that was used to confirm the input activation.

When no confirmation is received, the message is:

`.I,n:Active;Not Confirmed;`***`Location text;Input text`***

When the input is deactivated, the unit can also transmit a message to the phone number that confirmed the activation. This feature can be activated by placing 1 in the text field on index **n**5. The unit will send the following message:

`.I,n:Idle;`***`Location text;Input text`***

The same message is also send the log phone number, when not 0.

Activate macro

The macro present in the text field on index **n**0, is executed when the input is activated. This macro can be used to trigger a output. See **SMS Handling** on page 30 and **Call in** on page 44 for more information about macro's. The macro will use the output phone number on index **n**9 as source phone number. This is used when a message must be transmitted or a output must be set (Security level).

Deactivate macro

The macro present in the text field on index **n**6, is executed when the input is deactivated. This macro can be used to reset a output. See **SMS Handling** on page 30 and **Call in** on page 44 for more information about macro's. The macro will use the output log phone number on index **n**9 as source phone number. This is used when a message must be transmitted or a output must be set (Security level).

Led 1 (red)

During the time that the input activation is handled, led 1 (red) will be constant on.

Reset by SMS or Error

When the Alarm Transmitter is reset with a SMS message or a Error, the configuration is read from the phonebook.

When the text fields activation time (**n**3) and/or inverted (**n**4) are changed, the input is deactivated. This means that when a input was activated before reset but not handled, the activation will be lost. This will be the case when the input configuration is changed with a SMS message.

When the text fields activation time (**n**3) and/or inverted (**n**4) are NOT changed, the input is kept. This means that when a input was activated before reset but not handled, the activation will NOT be lost. This will be the case when there was a error that caused a reset of the Alarm Transmitter.

Power failure

Normally the unit is powered by the main power supply, but there is a battery present to power the unit in case the main power supply is no longer present. The unit can detect a power failure and transmit a SMS message as a reaction on this event. There is also a option to send a message when the main power is reapplied. A other option makes it possible to ignore any input activation during the power fail.

Required activation time

The text field on index 93, that can be between 0 and 86400 seconds, indicates how long the power failure state (working on battery) must be present before it is processed. When the power is reapplied before the activation time is passed, the power fail is ignored.

The term power fail in this document means that the power was lost longer than the activation time.

Confirm timeout = 0

The power failure is handled in two different modes, depending on the confirm timeout, located in text field 92. When the field contains 0, the timeout is 0. This means that there is no confirmation needed.

When the power failure is detected, the unit will transmit a SMS message to each phone number present on index 91 to 98. It will not send a SMS message when the phone number field contains a 0. The message will have the following format:

`.P,2:Active;`***`Location text;Power fail text`***

The ***Location text*** is the contents of the text field on index 01. The ***Power fail text*** is the contents of the text field on index 91. This can be used give the power fail a distinct name.

When the log phone number, located on index 90, is not 0, then a message is also transmitted to this phone number, after sending the SMS messages to the normal phone numbers. This message will have the same format.

When the main power is reapplied, the unit can also transmit a message to all the phone numbers. This feature can be activated by placing 1 in the text field on index 95. The unit will send the following message to the phone numbers on index 91 to 98 and when not 0, to 90 (in this order).

`.P,2:Idle;`***`Location text;Power fail text`***

Confirm timeout = 1…60

When the confirm timeout is between 1 and 60 minutes, the power fail must be confirmed.

When the power failure is detected, the unit will transmit a SMS message to first phone number present on index 91 to 98. It will not send a SMS message when the phone number field contains a 0. The message will have the following format:

`.P,2:Active;Confirm;`***`Location text;Power fail text`***

The ***Location text*** is the contents of the text field on index 01. The ***Power fail text*** is the contents of the text field on index 91. This can be used to give the power fail a distinct name. The Confirm indicates that the SMS message must be confirmed. This can only be done by the GSM phone that received the message. Use this phone to send a SMS message (can be a empty message), or to call the unit. When the unit detects ringing from the correct phone number it will wait 10 seconds and then hang-up. The confirmation was successful. When the hang-up is immediately, the confirmation isn't accepted (wrong phone number or to late).

The unit will wait as long as the confirm timeout for the confirmation. When a confirmation is received during this time, no other SMS message (except to the log phone number) is send.

When no confirmation is received, a SMS message is send to the next phone number that is present in the phone book, and the procedure is repeated.

When the log phone number, located on index 90, is not 0, then a message is also transmitted to this phone number, after confirmation:

`.P,2:Active;Confirmed;`**`x`**`;`***`Location text;Power failtext`***

The **x** is the phone number that was used to confirm the input activation.

When no confirmation is received, the message is:

`.P,2:Active;Not Confirmed;`***`Location text;Power fail text`***

When the main power is reapplied, the unit can also transmit a message to the phone number that confirmed the activation. This feature can be activated by placing 1 in the text field on index 95. The unit will send the following message:

`.P,2:Idle;`***`Location text;Power fail text`***

The same message is also send the log phone number, when not 0.

Ignore inputs

When the text field on index 94 contains 1, any activation of a input is ignored/lost during power fail. After reapplying the main power, the inputs must be reactivated before the input is handled (SMS is transmitted).

When the text field on index 93 isn't 0, any activation of a input will be handled during power failure. This will use a lot of energy from the battery.

Activate Macro

The macro present in the text field on index 90, is executed when the power fail is activated. This macro can be used to trigger a output. See **SMS Handling** on page 30 and **Call in** on page 44 for more information about macro's. The macro will use the power fail macro phone number on index 99 as source phone number. This is used when a message must be transmitted or a output must be set (Security level).

Deactivate Macro

The macro present in the text field on index 90, is executed when the power fail is deactivated. This macro can be used to reset a output. See **SMS Handling** on page 30 and **Call in** on page 44 for more information about macro's. The macro will use the power fail macro phone number on index 99 as source phone number. This is used when a message must be transmitted or a output must be set (Security level).

Led 1 (red)

During power failure the led 1 (red) will flash very short every 5 seconds.

Battery check

The Alarm Transmitter can check of the battery voltage is below a chosen voltage, when that is the case a SMS can be transmitted.

Threshold voltage

The threshold voltage will be compared with the actual battery voltage, when the battery is below the threshold, the battery will be marked as low and this can result in a SMS.

The threshold voltage in the text field on index 07, must be specified in 0.1V resolution, so to set the threshold voltage to 5.5V, place 55 in the field.

Valid values are between 0 and 100, so 0V and 10V. When you set the value to 0, the battery is never low, even when no battery is present. When you make the value 100, the battery is always low.

Power up or reset

When the Alarm Transmitter is powered up or is reset, it will measure the battery voltage. When the voltage is below the threshold voltage a SMS is transmitted when the phone number on index 05 isn't empty or 0. This SMS will have the following format

`.B,1:6.1V;`***`Location text`***`;Battery text`

The SMS will indicate the current battery voltage. The battery text is found in the text field on index 02.

Normal battery check time

The battery can be checked on a regular interval. The normal battery check time will give the length of the interval when power fail isn't active.

When the time between the last battery check (can be on power up) and the current time is greater than the normal battery check time, the battery is checked. When the battery voltage is below the threshold voltage a SMS is transmitted when the phone number on index 05 isn't empty or 0. This SMS will have the following format

`.B,1:6.1V;`***`Location text`***`;Battery text`

The SMS will indicate the current battery voltage. The battery text is found in the text field on index 02.

Normally this time will be very long, around 24 hours (1440 minutes).

Power fail battery check time

The battery can be checked on a regular interval. The power fail battery check time will give the length of the interval when power fail is active. This means that the Alarm Transmitter is working on the battery longer than the power activation time. When the time between the last battery check (can be on power up) and the current time is greater than the power fail battery check time, the battery is checked. When the battery voltage is below the threshold voltage a SMS is transmitted when the phone number on index 05 isn't empty or 0. This SMS will have the following format

`.B,1:6.1V;`***`Location text`***`;Battery text`

The SMS will indicate the current battery voltage. The battery text is found in the text field on index 02.

Normally this time will be a couple of hours.

Attention

Each time the battery is checked, extra current is drawn from the battery. This can shorten the life time of the battery.

Alive message

The battery check can be used to send a alive SMS on a regular interval. When you set the threshold to 100 (10V), the battery voltage will always be below the threshold and this will result in a SMS when the battery is checked. Set the normal battery check time to the time that must be between alive message. You will receive a SMS on a regular base. That SMS will indicate the current battery voltage.

Check time

The Alarm Transmitter doesn't have a real time clock, so there is no way to specify a absolute time to check the battery. The battery will be checked each time the Alarm Transmitter is powered up or goes through a reset. From that moment the battery check time will start running, when the time is up and the Alarm Transmitter is not busy with some other task (like waiting on a confirmation), the battery will be checked and the time will be restarted. Because there is no way to predict when the time is restarted, there is also no way to predict when the battery will be checked.

Outputs

The alarm transmitter has 4 open collector outputs on J7. This six pin connector has the following layout.

PIN	Name
1	Output 1
2	Output 2
3	Output 3
4	Output 4
5	GND
6	Vrel

The voltage on pin 6, Vrel, can be selected with J6.

Jumper between	Voltage
1 - 2	Power supply
2 - 3	3V6

The software has support 4 virtual outputs, they are only present in the software, but they can be set just like the real outputs. This can be useful for flags that can be set with a SMS and than can be read with a SMS.

So there are in total 8 outputs, 4 real and 4 virtual.

Inverted

Each output can be inverted by placing a 1 on index **n**8, where **n** indicates the output number between 1 and 8. When the output is inverted, the output will be low when the output is ON (transistor on). The output will be open (or high with a external pull-up) when the output is OFF (transistor OFF).

A not inverted output will be open (or high with a external pull-up) when the output is ON (transistor off). The output will be low when the output is OFF (transistor on).

	NOT INVERTED	**INVERTED**
ON	OPEN	LOW
OFF	LOW	OPEN

For virtual outputs, inverted has no meaning because there are no real signals (no transistors).

Activation time = 0

When the activation time, present in text field on index **n**7, is 0, the output will stay ON or OFF until it is changed with a SMS.

Activation time = 1..36000

When the activation time, present in text field on index **n**7, is between 1 and 36000, the output will stay ON as long as the activation time.

When a SMS is received that set the output ON, the output will be ON as long as the activation time and after that time the output will go to OFF. This result in a pulse on the output. When a new SMS is received that sets the output on, before the activation time is over, the output is kept ON and the time is restarted.

When a SMS is received that set the output OFF, the output will go immediate OFF.

This is the case for real and virtual outputs. This means that you can use a virtual output as a flag that stays active(ON) for a certain amount of time and than become inactive(OFF).

Security level

The value in the text field on index **n**9 indicates which phone numbers are capable of changing the outputs. When a SMS is received that changes the outputs, the phone number of the sender of the SMS is checked, to make sure that the output may be changed.

The value is a bit field with 8 bits, each bit indicates a phone number that is accepted.

Bit number for 7 to 0	**Phone number**
7	Don't check, always accept, all other bits are ignored
6	Phone number on index 09 is accepted (Call In 2)
5	Phone number on index 08 is accepted (Call In 1)
4	Phone number on index 02 is accepted (global output)
3	Phone number on index 04 is accepted (configuration)
2	Phone number on index **n**9 is accepted (log, input **n**)
1	Phone numbers on indexes **n**1 to **n**8 are accepted (Number x, input **n**)
0	Phone number on index **n**0 is accepted (Number, output **n**)

Bit 7 : No security

When this bit is set, all phone numbers are accepted, so any one can change the output by sending a SMS. All other bits are ignored.

Bit 6 : Call in 2

When this bit is set, a SMS from the phone number on index 09 is accepted. When there is no phone number (empty or 0), the bit is ignored.

Bit 5 : Call in 1

When this bit is set, a SMS from the phone number on index 09 is accepted. When there is no phone number (empty or 0), the bit is ignored.

Bit 4 : Global output

When this bit is set, a SMS from the phone number on index 01 is accepted. When there is no phone number (empty or 0), the bit is ignored.

Bit 3 : Configuration

When this bit is set, a SMS from the phone number on index 03 is accepted. This is the same phone number that can be used to change the phone book with a SMS. When there is no phone number (empty or 0), the bit is ignored.

Bit 2 : Output

When this bit is set, a SMS from the phone number on index **n**9 is accepted. with n the number of the output from 1 to 8. This number can be different for each output. When there is no phone number (empty or 0), this bit is ignored.

Bit 1 : Input numbers

When this bit is set, a SMS from the phone numbers on index **n**1 to **n**8 is accepted, with n the number of the output from 1 to 8. This are the report phone numbers of the input with the same number. This numbers can be different for each output.

Bit 0 : Input log

When this bit is set, a SMS from the phone number on index **n**0 is accepted, with n the number of the output from 1 to 8. This is the log phone number of the input with the same number. This number can be different for each output. When there is no phone number (empty or 0), the bit is ignored.

Security level value

Use the bits to create a decimal value from 0 to 255 and place that in the text field on index **n**9.

Examples

0	Output change isn't allowed
4	Output phone number on index **n**9 can change the output (bit 2 set)
24	Global output (index 01) and configuration (index 04) can change the output (bit 3 and 4 set)
128	Any phone number can change the output (bit 7 set)

SMS Handling

The Alarm Transmitter can receive SMS message and when they are in a valid format, will execute and/or respond to the SMS.

The SMS message must contain so called **DOT FIELDS**. A dot field starts with a dot (.) and then a upper case letter. After that letter there can be none, one or more than one **COMMA FIELDS**. The upper case letter indicates a module that must handle the comma fields. A comma field starts with a comma (,), the rest form the format depends on the dot field.

There can be more than on dot field, with his comma fields, present in the SMS message. This allows to get the status, read inputs, set outputs with same SMS.

Some fields generate a response, like reading a input. Some fields have no response, like setting a output. When the received SMS doesn't have a field with a response, no answer SMS is transmitted, otherwise a SMS with the response(s) is transmitted.

.I Dot field: Input

When dot field is .I it is handled by the inputs module. The module allows the reading of the inputs by any phone number.

The dot field must be followed by one of more comma fields with the following format:

,**n**?

With **n** the input number from 1 to 9. When n is 9, the power fail input is returned.

The current value of the inputs on the connector will be returned, ignoring the activation time. Inverted will not be ignored.

When n is 9, the Alarm Transmitter will check of it is currently powered by the power supply (Idle) or on the battery (Active).

Example:

SMS received	`.I,1?,2?,9?`
SMS transmitted	`.I,1:Active,2:Idle,9:Idle`

.O Dot field : Output

When dot field is .O it is handled by the outputs module. The module allows the writing and reading of the outputs. Only the phone numbers selected by the security level can write the outputs, all phone numbers can read the outputs.

There are two comma field possible, one is for reading, the other is for writing.

,n? Comma field

This comma field can be used to read a output with **n** the number of the output.

The returned value can be ON or OFF. The value is the current value of the output. When the output has a activation time above 0, and the output is set ON, the returned value will be ON as long as the activation time isn't over. After the activation time the output will be OFF. This is the case for all outputs (real and virtual).

Example:

SMS received	`.O,1?,5?`
SMS transmitted	`.I,1:ON,5:OFF`

,n:v Comma field

This comma field can be used to write a output with **n** the number of the output. The phone number that transmitted the SMS must be accepted (see security level) before the output is changed.

v can be ON or OFF.

There is no response to this field.

Example:

SMS received	`.O,1:ON,5:OFF`
SMS transmitted	***none***

.S Dot field : Status

When the dot field is .S it is handled by the status module. The module will get the actual status of the alarm transmitter. The status includes:

- Signal strength
- Powered by
- Battery voltage
- Current value of all inputs
- Current value of all outputs

The module allows the reading of the status by any phone number.

There are no comma fields for this dot field.

The answer format is

```
.S,ss,pwr,bv,Iiiiiiii,Oooooooo,vio,vgsm
```

ss : Signal strength

The signal strength is a value between 0 and 31. The lower the value, the weaker the signal. The value can also be 99, indicating that the signal strength is unknown.

pwr : Powered by

Indicates the current power supply of the Alarm transmitter.

BAT	Indicates that the Alarm transmitter is powered by the battery.
NET	Indicates that the Alarm transmitter is powered by the main power supply.

bv : Battery voltage

Gives the current battery voltage. This voltage will be measured when the status is generated.

Iiiiiiii : Input status

Gives the current value of the inputs (like .I). The I is followed by 8 numbers between 0 and 1. When the number is 0, the input is Idle. When the number is 1, the input is Active.

The first number after the I is for input 8, the last number is for input 1 (I87654321).

Oooooooo : Output status

Gives the current value of the outputs (like .O). The O is followed by 8 numbers between 0 and 1. When the number is 0, the output is OFF. When the number is 1, the output is ON.

The first number after the I is for output 8, the last number is for output 1 (I87654321).

vio : Software version IOProcessor

Gives the software version of the IOProcessor. The field has a major and a minor part separated by a dot.

vgsm : Software version GSM

Gives the software version of the GSM. The field has a major, a minor and a build part separated by a dot.

Example:

SMS received	`.S`
SMS transmitted	`.S,13,NET,5.9V,I01000100,O00100011,01.03,01.03.000001`

.C Dot field : Configuration

When dot field is .C it is handled by the configuration module. The module can read and write the configuration. When the configuration phone number on index 04 is empty or 0, any phone number can change/read the configuration. When the configuration phone number isn't empty, only that phone number can change/read the configuration.

IMEI number

For extra protection the SMS message must include the last four digits of the IMEI number of the GSM module of the Alarm Transmitter. This number can be found on the GSM module.

The IMEI number is placed after .C

Example

IMEI Number :	351266-00-047643-4
Dot field must start with:	`.C6434`

,Tix:value Comma field

This comma field is used to change the value of a text field. **ix** is the index of the text field from 1 to 99. **Value** is the new value for the text field. It can contain any letter, digit or special character, **EXCEPT** a comma (,), dot (.) or double quote (“). When you want a comma or dot in the value, surround the value with double quotes (“). The quotes aren't

stored in the phonebook (with this method it is impossible to store double quotes).

Examples

SMS received	`.C6434,T02:BATTERY LOW`
SMS transmitted	***none***

SMS received	`.C6434,T33:154`
SMS transmitted	***none***

SMS received	`.C6434,T08:".O,1:ON"`
SMS transmitted	***none***

,Nix:phone number Comma field

This comma field is used to change the value of a phone number field. **ix** is the index of the phone number field from 1 to 99. **Phone number** is the new value of the field. It can only contain digits (any other character will be skipped), except of dot or comma, they indicate the start of a next field.

Example

SMS received	`.C6434,N02:32499125634`
SMS transmitted	***none***

,Tix? Comma field

This comma field is used to read the value of a text field. **ix** is the index of the text field from 1 to 99. If the value contains a dot or a comma, the value is surrounded with quotes.

Examples

SMS received	`.C6434,T02?`
SMS transmitted	`.C,T02:BATTERY LOW`

SMS received	`.C6434,T33?`
SMS transmitted	`.C,T33:154`

SMS received	`.C6434,T08?`
SMS transmitted	`.C,T33:”.O,1:ON”`

,Nix? Comma field

This comma field is used to read the value of a phone number field. **ix** is the index of the text field from 1 to 99.

Examples

SMS received	`.C6434,N02?`
SMS transmitted	`.C,N02:32499125634`

Combined examples

SMS received	`.C6434,T02:ALIVE,T02?`
SMS transmitted	`.C,T02:ALIVE`

SMS received	`.C6434,N10:32499762345,N11:32499237845`
SMS transmitted	***none***

SMS received	`.C6434,T00:MEIR 3,N90:32499123456,T02?`
SMS transmitted	`.C,T02:ALIVE`

Important

Changing the configuration with a SMS means that the new values are written to the phone book. The software will read all phone numbers from the phone book when they are needed, so when they are changed the software will also use the new values.

The software will store some text fields in internal memory. Changing the values in the phone book doesn’t change the values in internal memory. The only way to update the internal memory is by a reset.

When the configuration (activation time, inverted) of a input or a output is changed, the alarm transmitter must be reset to use the new values.

.R Dot field : Reset

When dot field is .R it is handled by the reset module. The module will set a flag to indicate that the alarm transmitter must reset after sending the response SMS.

IMEI number

For extra protection the SMS message must include the last four digits of the IMEI number of the GSM module of the Alarm Transmitter. This number can be found on the GSM module.

The IMEI number is placed after .R

Example

IMEI Number : 351266-00-047643-4
Dot field must start with: .R6434

When the R is followed by a ?, there will be a response SMS.

SMS received .R6434
SMS transmitted ***none***

SMS received .R6434?
SMS transmitted .R

.P Dot field : Set Pin

When dot field is .P it is handled by the pin module. The module will change the PIN code that is used by the BDX104 T1000. The PIN code is stored in non volatile memory in the BDX104 T1000. The PIN code is used during power up to initialize the SIM card. So as long you don't power off the BDX104, it will not reinitialize the SIM and so it will not use

the new PIN code. This can be useful when you change the PIN to the wrong number. The SMS message that you use to change the pin code must contain the PIN two times. This is used to make sure that the received PIN is the wanted pin. A SMS is transmitted when the PIN code is changed, so you are sure (except when the SMS message get lost), that the PIN code is changed.

IMEI number

For extra protection the SMS message must include the last four digits of the IMEI number of the GSM module of the Alarm Transmitter. This number can be found on the GSM module.

The IMEI number is placed after .P

Example

IMEI Number :	351266-00-047643-4
Dot field must start with:	.P6434

,A:pin Comma field

The A comma field is gives the new PIN code. This is stored in temporary memory called A.

,B:pin Comma field

The B comma field is gives the new PIN code. This is stored in temporary memory called B.

PIN code check

Both the A and B comma fields must be present and must have the same PIN. The BDX104 T1000 will compare the temporary memories A and B to make sure that the PIN code is good.

Answer

The BDX104 will respond to a P field with one of this three messages:

.P Received message is not in correct format or IMEI number is incorrect.

.P,BAD Received message is in correct format but PIN code of A and B comma fields aren't the same or there is only one field given.

.P,ERR Received message is in correct format but PIN code can't be written to BDX104 memory, the default PIN code (see **SIM and PIN code** on page 5) will be used.

.P,OK Received message is in correct format and PIN code is changed.

Examples

SMS received `.P6434,A:1234,B:1234`
SMS transmitted `.P:OK`

SMS received `.P6434,A:9999,B:999`**`0`**
SMS transmitted `.P:BAD`

SMS received `.P6434,A:0000,B#0000`
SMS transmitted `.P`

Combined examples

Example 1

SMS received
`.O,1:ON,3:OFF.S`

SMS transmitted
`.S,13,NET,5.9V,I01000100,O00100011`

Example 2

SMS received
`.C6434,T13:2,T14:0,T23:2,T15:0.R6434?`

SMS transmitted

```
.R
```

Example 3

SMS received

```
.I,1?.O,3?.I,4?.C6434,T13?
```

SMS transmitted

```
.I,1:Active.O,3:OFF.I,4:Idle.C,T13:2
```

Example 4

SMS received

```
.O,3:ON,4:On,5:ON,5?,4?,3?
```

SMS transmitted

```
.O,5:ON,4:ON,3:OFF
```

(3 is off because activation time was 500ms and it took longer to parse the received SMS, so the actual value of output 3 was OFF on the moment that the 3? comma field was executed)

Reset

By Error

When the Alarm Transmitter can't send a SMS it will retry 6 times to send the SMS, each time waiting a couple of seconds before retrying. When the SMS is not transmitted after 6 tries, the Alarm Transmitter will reset itself. This will reinitialize the GSM engine and SIM card making it more likely that the SMS can be transmitted.

The same procedure is used when the phonebook is read. When that doesn't succeed in 6 tries, the Alarm Transmitter will also reset itself.

By software hang-up

When the software stops working the Alarm Transmitter will be reset by a watchdog circuit.

Reset consequences

After reset the Alarm Transmitter will reinitialize. Some text fields in the phone book are read and placed in the internal memory. Than the Alarm transmitter will check of there are active inputs, when that is the case it will follow the procedure described in **Inputs** on page 13.

When a input was active and handled before reset, it will be handled again. The reason this is done is because the reset can be done because we tried to send a SMS for that input but that failed. By handling it again we make sure the SMS is transmitted.

Each time the unit reset, the startup message is transmitted (when startup phonenumber isn't empty or 0). This can be used to see when the Alarm Transmitter reset.

Each time the unit reset, the battery check is performed and the check time is restarted.

All output are kept on there actual values (activation times work normal), except when the configuration was changed. In that case the output will go to OFF.

All inputs are processed, with the normal activation time, during the reset sequence, so that no inputs get lost, except when the configuration was changed. In that case the input must be reactivated after the reset sequence.

The reset sequence takes a lot of time and during this time no SMS or Phone call can be received. The SMS will be kept by the SMS Service Center, but a phone call will be lost.

Times

Because of the way the software is executed, the timings aren't exact. There can be a big difference between the time placed in the phonebook and the real time. The real time will always be the same or longer, never shorter. Most of the time it will be a few seconds longer but it can be that it is tens of a seconds longer (when transmitting many SMS messages in a row).

The activation times of the inputs/outputs can be longer but

- less than 1 second for times between 0 and 60 sec
- less than 5 seconds for times between 60 and 3600 sec

Call in

When the Alarm Transmitter is called by the phone number on index 08 or 09, and there is no confirmation cycles busy, the Alarm Transmitter will execute the macro in the text field on the same index as the phone number. Both indexes will be checked so you can place the same phone number on both indexes to execute both macro's. The macro must have the same format as a received SMS, like explained in **SMS Handling** on page 30. The macro is stored in a text field of a SIM card resulting in a maximum length of only 14 characters (for most SIM cards).

When the macro contains a question, the answer SMS will be send to the calling phone number.

The phone will ring for about 5 seconds and then will be hang-up.

Example of use:

You have a garage door that can be opened with a push button but now you want to open the door by calling the Alarm Transmitter.

You connect output 1 to the push button and set the activation time to 3 seconds. (Make also sure that the security level is above 0 and the phone number is accepted) You place your GSM phone number on index 08 and place the following macro in the text field on the same index:

```
.O,1:ON
```

When you now call the Alarm Transmitter with your GSM, it will receive the call and after 5 seconds hang-up the call, and then it will activate output 1 for 3 seconds, resulting in a opening of the door.

Because there are two call in phone numbers, each with there own macro, it is possible for your wife to open here garage door with here GSM.

Important

The macro is execute like a normal received SMS from the calling phone number, thus all options that can prevent the execution of a SMS (like output security level), will also prevent the execution of the macro.

You can use a configuration SMS to store the macro's in the phonebook, but make sure you surround the macro with double quotes (") in the SMS.

Example:

SMS received	`.C6434,T08:".O,1:ON"`
SMS transmitted	***none***

Call in with telephone number on indexes n1 to n9

A output can also be activated by a call in with a phone number stored on location n1 up to n9, where n is the output number from 1 to 4.

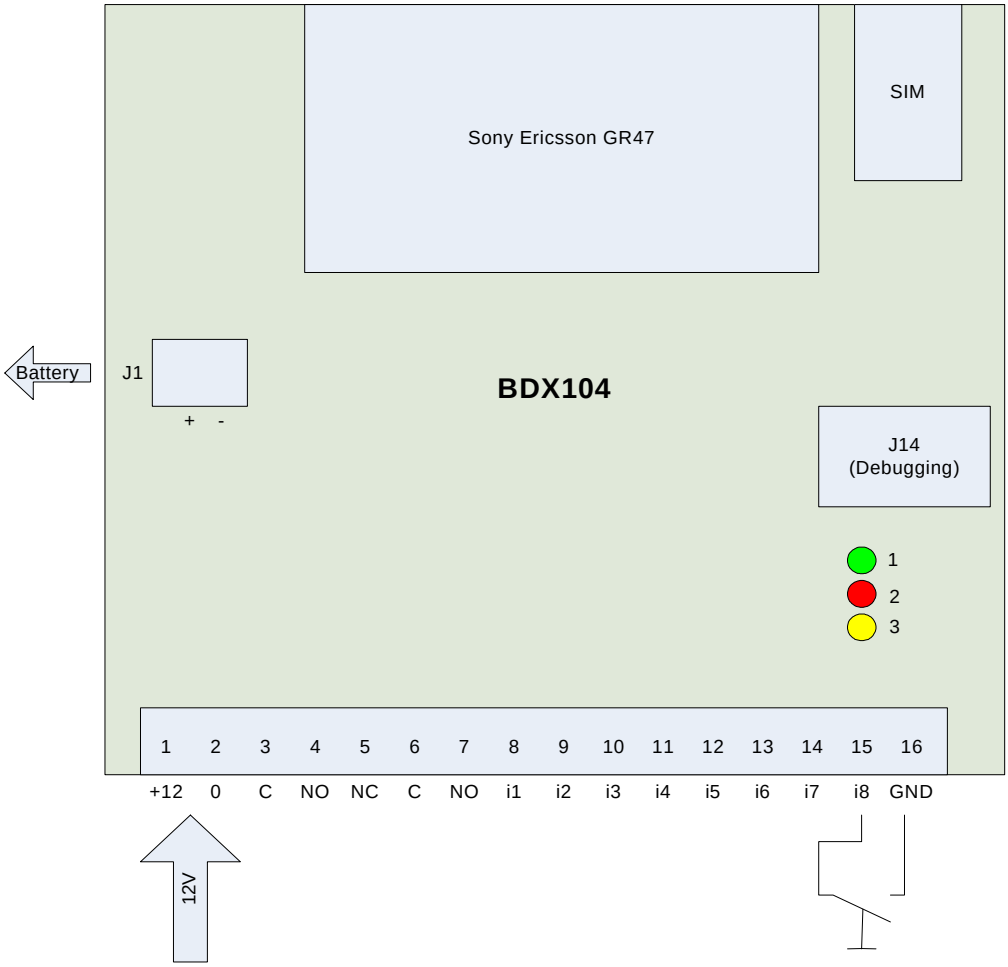
When the call in is made and the calling phone number is found on indexes n1 to n9, the unit will execute the macro .O,***n***:ON, with ***n*** the number of the output. It is just like sending this macro from the phone.

It is important that the security level of the output is set so that the phone number is accepted and the macro can be executed.

This feature makes it possible to activate a output with up to 11 phone numbers.

Connections

The following figure shows the connection of the BDX104 board.



Phonebook template

This template can be used to write down the configuration.

Index	Text field	Phone number field
01	Location text	Startup
02	Battery text	Global output
03	Monitoring on/off	Monitoring
04	Debugging on/off	Configuration
05	Normal battery check time	Battery
06	Power fail battery check time	
07	Battery low voltage threshold	
08	Call in 1 macro	Call in 1
09	Call in 2 macro	Call in 2
10	Activate macro, input 1	Log, input 1
11	Input text, input 1	Number 1, input 1
12	Confirm timeout, input 1	Number 2, input 1
13	Required activation time, input 1	Number 3, input 1
14	Inverted, input 1	Number 4, input 1
15	Send deactivate message, input 1	Number 5, input 1
16	Deactivate macro, input 1	Number 6, input 1
17	Activation time, output 1	Number 7, input 1
18	Inverted, output 1	Number 8, input 1
19	Security level, output 1	Number, output 1
20	Activate macro, input 2	Log, input 2
21	Input text, input 2	Number 1, input 2
22	Confirm timeout, input 2	Number 2, input 2
23	Required activation time, input 2	Number 3, input 2
24	Inverted, input 2	Number 4, input 2
25	Send deactivate message, input 2	Number 5, input 2
26	Deactivate macro, input 2	Number 6, input 2
27	Activation time, output 2	Number 7, input 2
28	Inverted, output 2	Number 8, input 2
29	Security level, output 2	Number, output 2
30	Activate macro, input 3	Log, input 3
31	Input text, input 3	Number 1, input 3
32	Confirm timeout, input 3	Number 2, input 3
33	Required activation time, input 3	Number 3, input 3
34	Inverted, input 3	Number 4, input 3
35	Send deactivate message, input 3	Number 5, input 3
36	Deactivate macro, input 3	Number 6, input 3

37	Activation time, output 3	Number 7, input 3
38	Inverted, output 3	Number 8, input 3
39	Security level, output 3	Number, output 3
40	Activate macro, input 4	Log, input 4
41	Input text, input 4	Number 1, input 4
42	Confirm timeout, input 4	Number 2, input 4
43	Required activation time, input 4	Number 3, input 4
44	Inverted, input 4	Number 4, input 4
45	Send deactivate message, input 4	Number 5, input 4
46	Deactivate macro, input 4	Number 6, input 4
47	Activation time, output 4	Number 7, input 4
48	Inverted, output 4	Number 8, input 4
49	Security level, output 4	Number, output 4
50	Activate macro, input 5	Log, input 5
51	Input text, input 5	Number 1, input 5
52	Confirm timeout, input 5	Number 2, input 5
53	Required activation time, input 5	Number 3, input 5
54	Inverted, input 5	Number 4, input 5
55	Send deactivate message, input 5	Number 5, input 5
56	Deactivate macro, input 5	Number 6, input 5
57	Activation time, output 5	Number 7, input 5
58	Inverted, output 5	Number 8, input 5
59	Security level, output 5	Number, output 5
60	Activate macro, input 6	Log, input 6
61	Input text, input 6	Number 1, input 6
62	Confirm timeout, input 6	Number 2, input 6
63	Required activation time, input 6	Number 3, input 6
64	Inverted, input 6	Number 4, input 6
65	Send deactivate message, input 6	Number 5, input 6
66	Deactivate macro, input 6	Number 6, input 6
67	Activation time, output 6	Number 7, input 6
68	Inverted, output 6	Number 8, input 6
69	Security level, output 6	Number, output 6
70	Activate macro, input 7	Log, input 7
71	Input text, input 7	Number 1, input 7
72	Confirm timeout, input 7	Number 2, input 7
73	Required activation time, input 7	Number 3, input 7
74	Inverted, input 7	Number 4, input 7
75	Send deactivate message, input 7	Number 5, input 7
76	Deactivate macro, input 7	Number 6, input 7
77	Activation time, output 7	Number 7, input 7
78	Inverted, output 7	Number 8, input 7
79	Security level, output 7	Number, output 7

80	Activate macro, input 8	Log, input 8
81	Input text, input 8	Number 1, input 8
82	Confirm timeout, input 8	Number 2, input 8
83	Required activation time, input 8	Number 3, input 8
84	Inverted, input 8	Number 4, input 8
85	Send deactivate message, input 8	Number 5, input 8
86	Deactivate macro, input 8	Number 6, input 8
87	Activation time, output 8	Number 7, input 8
88	Inverted, output 8	Number 8, input 8
89	Security level, output 8	Number, output 8
90	Macro, power fail	Log, power fail
91	Power fail text, power fail	Number 1, power fail
92	Confirm timeout, power fail	Number 2, power fail
93	Activation time, power fail	Number 3, power fail
94	Ignore inputs on power fail	Number 4, power fail
95	Send power recovery message	Number 5, power fail
96		Number 6, power fail
97		Number 7, power fail
98		Number 8, power fail
99		Macro, power fail