TeleControl

USER'S MANUAL 4.8

Read this manual carefully and keep it with the unit for future reference.

Contents

1. INTRODUCTION

TeleControl, later simply referred to as TC, is a two-way remote control and monitoring unit. TC offers a customized solution for many different applications and requirements as its operation logic can be programmed to meet the needs of the customer. The most typical uses of TC are the monitoring and remote controlling of summer cottages, private homes, and real estates. TC can also well be utilized in passage control, data transfer, telemeasuring, and monitoring of various devices and gadgets.

TC is controlled by GSM Short Messages (SMS) and phone calls; therefore, the unit functions wherever there is adequate GSM network coverage with GSM SMS services. The strong security of TC is based on the fact that a command or a query is executed only if it is sent from a trusted phone number. The unit keeps a list of trusted phone numbers in its internal phone directory, and each of those phone numbers can have differing levels of access rights to the unit.

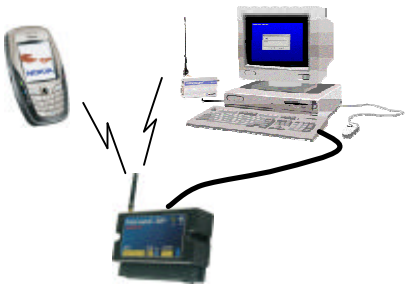
Although TC has a large command set, the most frequently used commands can be labelled with descriptive titles so that remembering and using them is easier. Commands are then simply executed by sending GSM Short Messages such as #DOOR OPEN and #HEATING ON to TC. These so-called macro commands allow TC to be used in many different languages and to be customized to your preferences.

You can send and receive information from TC by using a normal GSM phone, a fixed network phone, or the TeleCont monitoring room application. TeleCont is a web browser based application that can be run on your computer or it can be accessed from anywhere over the Internet. If you want to use TeleCont over the Internet, all you need is Internet access and the latest Microsoft Internet Explorer web browser, and you are ready to go. TeleCont has been designed for management of TeleControl devices, and receiving, processing, and transferring alarms messages. TeleCont offers comprehensive capabilities for processing TC's alarm messages and measurement data from your web browser. For more information about our products, please visit our web site at www.telemic.fi.

1.1 Using TeleControl

TC can be accessed

- by sending GSM Short Messages (SMS) or
- by using your computer (data cable connection) or
- by using GSM data connection or
- by using the TeleCont monitoring room application (locally or over the Internet).



All commands and question messages must begin with the hash sign (#). TC will reply to the sent command by confirming the action or if a value such as temperature was asked, the current value will be returned. If TC could not understand the command or question, it will respond by sending you a message containing text "Unknown command".

1.2 About This Manual

The command layout in this manual uses two different colours to distinguish the command part from the qualifying parameters. The command part is always presented on dark grey background and the parameters following it are on light grey background. If you are reading this in PDF format, the command part is on blue and the associated parameters are on yellow backgrounds.

Command name

P x y

# = a command or a question must always begin with a hash sign
P = the command letter, for example P stands for phone directory
x = the parameters, for example #P3? asks for the phone number in the memory cell 3 of the phone directory

☞ You can browse through the terminology used in this manual and in control systems in general from the alphabetical index at the end of this manual. The alphabetical index contains page numbers for quick searches of information.

1.3 TeleControl Models

There are three different TeleControl models: TC31i+, TC42i+, and TC84i+. The basic difference between the models is the number of physical connectors.

Table TeleControl model differences.

Feature	***TC31i+***	***TC42i+***	***TC84i+***
ON / OFF information inputs	3	4	8
Outputs	1	2 (+2)	4 (+4)
TC as a data modem	no	no	yes
Total number of alarm channels	6	11	15
Low voltage alarm	yes	yes	yes
Power failure alarm	yes	yes	yes
Audio support	no	yes	yes
GPS support	no	no	yes
Power save mode	yes	no	no
Temperature or 4-20 mA current information channels	3	1 (+4/4)	1 (+4/4)

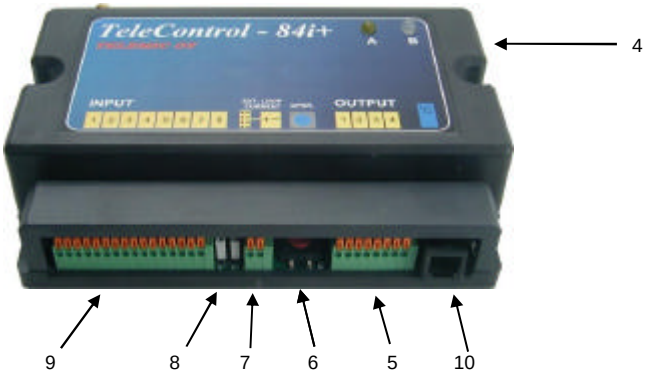
( ) = Requires an external card.

This manual describes alarm channels as they apply to TC84i+.

2. FEATURES

2.1 Parts of TeleControl

1. **RS-232 serial connector**
2. **Audio connector** (MIC and EAR)
3. **Power supply connector**
4. **Indicator lights** (A = yellow and B = red/green)
5. **Relay contacts** (4) are potential free.
6. **Operation switch** is used for switching between normal (monitoring on) and programming operation modes.
7. **Connector** for an external power supply for inputs.
8. **Mode selectors** are used for selecting either internal or external power supply for inputs.
9. **ON / OFF inputs** (8) Control circuits are connected to ON / OFF inputs. Two side-by-side connectors make up one input.
10. **Connector for the external AD-4 / RE-4 conversion card**
11. **GSM antenna connector (SMA)**
12. **SIM card holder**



2.1.1 Indicator Lights

TC has two indicator lights (A and B). The yellow light (A) indicates the status of the selected alarm channel (1…19) or relay contact (1…4). The examined alarm channel or relay can be selected by using the operation switch (6). For more information, see chapter 3.3.1.

Table Light A indicates the state of the selected alarm channel or relay.

Light A	*The state of the alarm channel or relay*
blinks rapidly.	The alarm channel is on and activation time is running.
is on.	The alarm channel has been activated or the relay is on.
goes off.	The alarm channel returns to passive state because the deactivation time has elapsed.
blinks slowly.	The alarm channel is returning to passive state before the alarm was activated. The light blinks slowly for the duration of the deactivation time.

Table Light B indicates the state of the device.

Light B	*The state of the device*
blinks about once a second in green.	TC is in normal mode.
blinks in red.	TC is in programming mode.
blinks in green and red.	TC is in disable mode.
flashes in red.	TC is saving data into non-volatile memory.
blinks rapidly in red.	TC is sending or receiving a GSM Short Message.
is on in red.	TC has lost connection to the GSM module.

2.1.2 Commands

TC accepts only those GSM Short Messages and phone calls that originate from allowed phone numbers. TC responds to all commands by sending a confirmation message back to the user. Some confirmation messages can be switched off by choice. For more information, see chapter 4.8.2.

You can also pass commands to TC through serial port by connecting a data cable between TC and your computer (see chapter 3.2.1). It is also possible to feed commands to TC through GSM data connection from an allowed phone number (see chapters 4.1.3 and 5.6.8).

Commands are always distinguished by the hash sign (#). This character can not be used in command parameters (for an exception to this rule, see chapter 4.9). In any command with several parameters, you can give just as many parameters as you need from the beginning of the command and leave out parameters from the end. If you want to grant access rights to a user, you have to give the phone number and the permission level in a single command. For example, **#P1 +35844111111 2** is a valid command for inserting a phone number and a permission level in the TC's internal phone directory. TC will respond to the sent command with a confirmation message that contains verification of the modified settings.

Commands can be chained together to fit into one single GSM Short Message or terminal line (if you use TC from your computer). Each and every command must begin with the hash sign **(#)**. Commands can be chained together as follows: **#P1 +35844111111#P2 +35850222222#P3 +35840333333**.

Alphabetical characters in commands are case-insensitive, which means that commands can be given either in upper or lower-case. Commands **#O1 1** and **#o1 1** work equally well.

You can query the current settings of the device by appending a question mark at the end of the command character. For example, command **#P?** gives you a listing of the phone numbers in your TC. The command will return the first 21 phone numbers from the TC's internal phone directory (see chapter 4.1.1). TC will send more than one GSM Short Message if there is not enough room for all outgoing

information in one message. The order in which the GSM Short Messages arrive in your mobile phone can be different from the intended order. This is caused by your operator's GSM SMS service.

You can include commands in alarm messages by using a forward slash (/) in front of the hash sign (#). This prevents the included command from being executed when the intention is to only modify device settings. For example, **#I2 1 1 1 10 Alarm /#O1 2 10** changes the state of relay 1 in the case of an alarm.

Unknown command

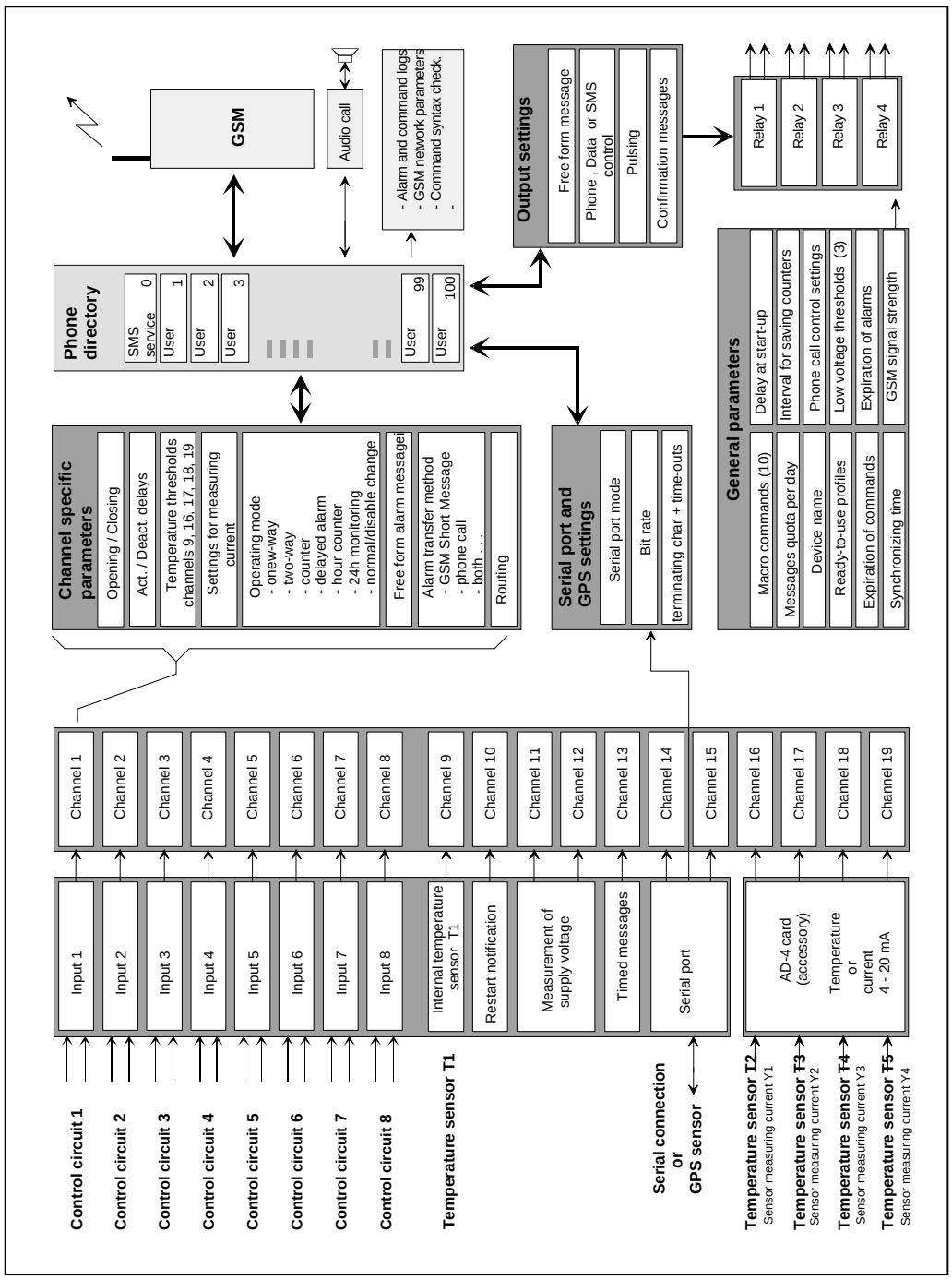
If TC receives a command it does not understand although it reminds a valid command, TC will return the message "Unknown command" to the sender.

Table Example question messages and commands.

Command	*Explanation*
#P?	Returns the phone numbers from directory memory cells 0 through 20.
#P50-55?	Returns the phone numbers from memory cells 50 through 55.
#P5??	Prints out the phone number and the macro commands from memory cell 5.
#Px nnnnnnn	Sets the phone number nnnnnnn to the memory cell x.
#I?	Prints out the settings of all alarm channels.
#Ix a b c d yyyyyy	Sets parameters a b c d and the alarm message yyyy to the alarm channel x.
#O?	Returns the statuses of all outputs.
#Ox?	Returns the status of the output x (x=1...4).
#Ox 0 or #Ox 1	Opens (0) or closes (1) the relay x.
#Ox 05 20	Sets the output x to give 20 pulses, each 0.5 seconds long.
#S6?	Prints out temperatures from sensors T2 through T5 without the associated alarm threshold values.

2.1.3 Command Interpreter

The part of the software inside TC that processes the received commands is called a command interpreter. The commands are interpreted in the same manner regardless of the method of use (GSM Short Messages or data connection). The command interpreter checks for the validity of the received command, executes it, and sends out a confirmation message in response. The confirmation message tells the user whether the command was executed successfully or not. If there is a syntax error in the command and the command interpreter cannot recognize the command, it will respond with an error message.



Picture TC's Block Diagram

2.2 Features in Brief

2.2.1 Inputs

Typical accessories that can be connected to TC's inputs are burglar alarms and smoke and humidity detectors. Information that is received from these accessories is transferred to a logic unit called an alarm channel in TC.

2.2.2 Alarm Channels

An alarm channel is a logic unit in software that controls the behaviour of TC. It is possible to adjust the operation of a TC by modifying its settings. Information that is received from an input is processed in the associated alarm channel. There are 16 alarm channels in TC or as many as 19 if an external AD-4 conversion card is used. All alarm channels operate independently of each other, so the settings for them are channel specific as well. By default, alarm messages are sent to every phone number in the TC's internal phone directory, but of course, the message recipients can also be selected channel by channel. Alarm messages are sent as GSM Short Messages, but an alarm condition at the monitored location can also be brought to the attention of the user by phone calls. However, phone calls are not able to carry further information about the alarm as GSM Short Messages.

2.2.3 Event Counter

Alarm channels can also be used as event counters. An input's event counter is incremented by one every time the input becomes active. All event counters are 32-bits long with maximum value of 4 294 967 295. TC can send an alarm message upon reaching a specified value.

2.2.4 Hour Counter

Any alarm channel can be set to operate as an hour counter. When an input is in active state, the associated counter counts time as seconds or hours instead of events. TC can send an alarm message after specified time or when hour counter reaches a certain value.

2.2.5 Outputs

There are altogether four relay contacts - or outputs - in TC. The user can set a relay on or off by sending a command or by making a phone call to TC. After TC has executed the command, it will reply with a confirmation message containing the current status of the output in question. The command can be supplied with time limit, after which the output will go back to its previous state. This feature can be used, for instance, in opening and closing electric locks. An output can also be pulsed, that is, the state of the output changes between on and off as many times as instructed.

2.2.6 Timed Messages

TC can be programmed to send out messages periodically. This feature is useful in determining whether the unit is alive or not. The contents of these scheduled messages can be anything you want. Timed messages can prove to be an excellent way of collecting event or hour counter values and measurement data from TC to TeleCont application. For more information, see chapter 4.3.3.

Timed messages are always sent through channel thirteen. The sending of timed messages is suppressed by default.

2.2.7 Non-Volatile Memory

All settings in a command are saved in non-volatile memory after the command is executed. This default behaviour can be changed with command #A33 x (see chapter 5.5.5). The up-to-date values of event and hour counters are saved in non-volatile memory periodically. The saving interval can be given with command #A3 (see chapter 5.3.5). The default interval is ten minutes.

Non-volatile memory can be cleared by holding the operation switch down when the power is switched on. The operation switch must be held down (for about 4 to 5 seconds) until the indicator light A has flashed in yellow and the indicator light B has flashed in green.

2.2.8 Phone Calls and Audio Connection

TC is capable of picking up incoming phone calls (see chapter 4.7), therefore, it is possible to set a relay on or off, switch from one operating mode to another, or even build up an audio connection to TC by a phone call.

TC immediately cuts off any phone calls that are not from those phone numbers mentioned in the TC's internal phone directory. This protects your TC from any mischief that might be caused by ill-advised phone calls. This feature can be switched on with command #A8 1, and indeed, it is on by default.

You need a speaker and a microphone attached to your TC in order to build up a two-way audio connection between you and your TC.

☞ Remote listening is illegal in most countries unless it is clearly indicated that there are listening apparatuses in the area.

2.2.9 Data->SMS / SMS->Data

Data received through the serial port is forwarded as GSM Short Messages in the same manner as alarm messages. Correspondingly, incoming GSM Short Messages can be directed to the serial port (see chapter 5.6).

2.2.10 External AD-4 Conversion Card

TC can be furnished with an external AD-4 conversion card hosting four analogue inputs. NTC temperature sensors or sensors measuring 4-20mA current can be connected to these inputs. The AD-4 conversion card must be connected directly to the appropriate connector (10) in TC or to the connector on RE-4 relay card (AD). The AD-4 card provides alarm channels from 16 to 19 (see chapter 2.2.10).

2.2.11 External RE-4 Relay Card

TC can be equipped with an external RE-4 relay card with four power relays. The RE-4 relay card is connected to the connector (10) displayed at the beginning of this manual. The maximum power loading for relay contacts and spring connectors is 230VAC / 12A. The power relays work in unison with the TC's own low voltage relays if parameter #A42 is not set to value 1.

2.2.12 Alarm Messages

By default, all alarm messages have a fixed part and a user defined part. The fixed part is either **INx:+** or **INx:-** depending on whether the alarm has been activated or deactivated. Character x marks the number of the input. Some example alarm messages:

IN2:+ Door open for over 10 minutes

IN5:+ Intruder detected

In the first example we can see that the user has programmed message "Door open for over 10 minutes" for alarm channel two. This message is sent when the alarm channel two becomes active. The second example shows a message that could be sent when a motion sensor connected to the control circuit five detects movement at your home.

The fixed INx part is primarily meant to be used in association with the web browser based TeleCont application, and it can be easily removed from all alarm messages if need be. For more information, see chapter 5.5.1.

2.3 Operating Modes

TC has three different operating modes:

Programming mode (indicator light B blinks in red)
Normal mode (indicator light B blinks in green)
Disable mode (indicator light B blinks in red and green)

You can jump from one mode to another by pressing the operation switch (6). You can also switch from the programming mode to the normal or disable mode by issuing command #ON.

2.3.1 Programming Mode

It is important to realise that TC is not protected from mischievous use in the programming mode. Anyone can send commands to TC and modify its settings. TC enters this mode automatically when it is started first time. This mode can be achieved from normal operating mode by holding the operation switch (6) down for more than three seconds.

The monitoring and remote controlling features are in use even when the unit is in the programming mode. The indicator light B blinks in red when this mode is selected.

The unit can be switched from the programming mode back to the normal or disable mode by pressing the operation switch or by sending command #ON to TC. This, however, requires that there is at least one phone number listed in the TC's internal phone directory.

2.3.2 Normal Mode

This is the most usual operating mode. In this mode, TC is fully protected against illegal users because it only accepts commands that come from trusted phone numbers that are kept in its internal phone directory. If your TC is in programming mode, you can jump to this mode by pressing the operation switch (6) momentarily.

The indicator light B blinks in green when this mode is selected.

2.3.3 Disable Mode

TC does not send alarm messages in disable mode, apart from those alarm channels that have been explicitly set to 24h monitoring (see chapter 4.2.1). All outputs, event and hour counters, and other features function normally. The indicator light B blinks in red and green when your TC is in disable mode.

The disable mode can be switched on or off

- by alarm channel or
- by issuing command #ON #OFF or
- by making a phone call (see chapter 4.4).

TC can execute predefined macro commands when it is switched from the normal mode to the disable mode, or vice versa. For example, TC can close the water solenoid valve, switch off electricity, etc., when the operating mode changes (see chapter 4.4.6).


Although the operating mode can be changed by several different means, it is strongly recommended that only one method is used to avoid confusion about the current operating mode of your TC.

Perimeter Protection

Perimeter protection is not really an operating mode in TC, but it can be mimicked by utilizing the capabilities of the disable mode. In perimeter protection you change the default behaviour of one or more alarm channels so that the monitoring for these channels is actually on even though TC itself is in disable mode. This is useful, for example, if you want to protect your home or garage from trespassers in the middle of the night when you are sleeping in the monitored house.

The perimeter protection can be turned on by using a separate switch or by sending a GSM Short Message to TC. It is recommended that a separate switch is used because perimeter protection is not shown in the indicator lights or status queries.

2.3.4 Operating Mode Change by Phone Call

To switch the monitoring on, all you have to do is to make a phone call to the TC's GSM subscription. You will hear one or two beeps, which lets you know in what mode TC will be switched to when you close the phone. One beep means that the monitoring is about to be switched on, and a series of two beeps means that the monitoring is about to be switched off. This behaviour is similar to the logic that is used in many electric locks in modern cars. A car's turn indicators flash once when the locks are closed and twice when the locks are opened. To enable operating mode change by phone calls for a specific user, you must substitute a macro command number with number 101 when adding the phone number in the phone directory (see chapter 4.1.1).

3. INSTALLATION AND TESTING

TC must be installed in a dry and warm environment. If devices that require 230 volts are connected to the external relay contacts of TC, the installation must be performed by a qualified electrician. TC must be off during installation.

None of the connectors have screws, so tools are not needed in connecting external devices to your TC. Peel off about 5-7mm of the insulating material from the conducting wire and push the wire into the connector. The conducting wire can be taken off from the connector by pushing the orange button above it and pulling the wire carefully. Do not fold the wire before pushing it into the connector. It is difficult to detach the wire from the connector after it is folded.

It is recommended that wiring is arranged according to the circuit diagrams at the end of this manual if possible. This not only allows you to take full advantage of the preconfigured settings of your TC but also makes it possible to upload Telemic's ready-to-use configuration files from your computer to your TC.

It is always advisable to go through the installation steps laid out in this manual. The best way to upload the desired settings to your TC is to use the HyperTerminal program from your Windows operating system. All you have to do is to enter the commands in a plain text file or a template file with Notepad and use HyperTerminal for uploading. This ensures that the setup of your TC is always documented in a text file on your computer. You can make changes to the settings simply by editing the file and reloading it to TC. Another way of getting the desired settings to your TC is to give them command by command from HyperTerminal or by sending GSM Short Messages. You are free to use any terminal program of your choice although only HyperTerminal is covered in this manual.

3.1 PIN Code and Start-up

PIN code must be always switched off before inserting a SIM card into TC. You can switch it off from the SIM card by using your own mobile phone. Consult the instructions of your mobile phone for how to accomplish this. PIN code prompt is enabled in all new SIM cards by default. After you have installed your SIM card, you can switch TC on. The indicator light B blinks in red if the phone directory is empty. If there are phone numbers in the directory, the light B indicates the current operating mode.

3.2 Settings

It is strongly recommended that the settings of your TC are kept in a text file on your computer unless the ready-to-use operating profile (#E2 1) is not suitable for the monitored location. This effectively documents the settings that will most certainly be needed when your monitoring system is expanded or modified in some way in the future. We have come to realize that settings files can save a lot of time and work.

Make sure that there is just one number (your own mobile number) in the phone directory if you are testing the unit so that the plausible alarm messages do not bother other users needlessly. After you have completed testing, add the rest of the phone numbers in the phone directory and make sure that everything works as expected.

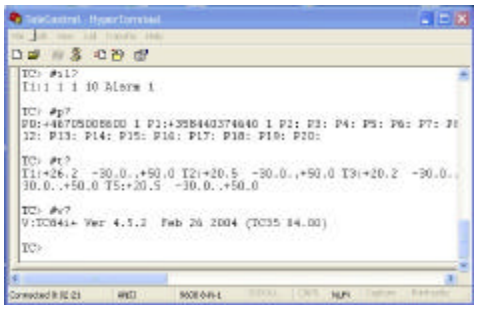
3.2.1 HyperTerminal

In addition to GSM Short Messages, you can send commands to TC by using a data cable or a GSM data connection. The data cable must run from the serial port of your computer to the TC's serial port. The settings of the cable connection are as follows:

- 9600 bits/s
- 8 data bits
- No parity and no hand-shaking

With data cable connection you can send commands to TC regardless of its operating mode and GSM connection.

If you are in Scandinavia, the font type must be set to "Courier New" from the View menu. Otherwise, Scandinavian characters (ÅÄÖ) will not appear correctly on the screen. In addition, change "Line Delay" to 100ms from File / Properties / Settings / ASCII / Setup / Line Delay. This gives TC enough time to process each command after you hit enter.



Picture HyperTerminal program is available on Windows.

3.2.2 Uploading Text Files

You can upload a settings file to your TC by simply clicking "Send Text File" from your HyperTerminal. You can create the text file from scratch with Notepad or use a template file as the basis for your settings. This procedure enables you to plan your settings carefully and send them to TC quickly in one session after the physical installation of the device is complete.

An example settings file is shown below. The file contains commands for setting a phone number in the TC's internal phone directory and settings for input 2.

#A33 3
#P1 +358xxnnnnnn
#A10 Cottage
#I2 2 0 1 60 Door open $Door closed
#A33 0

The above settings have the following effect: the alarm message "Cottage IN2:+ Door open" is sent to the phone number in memory cell P1 if the input 2 becomes active. "Cottage IN2:- Door closed" is sent when the door is closed.

☞ The text file must always begin with **#A33 3** and end with **#A33 0** (see chapter 5.5.5).

3.2.3 Downloading Settings in a Text File

TC is capable of printing its current settings in a text file. You can edit the downloaded text file and upload it back to TC using HyperTerminal.

1. Select Transfer / Capture Text from the menu.
2. Enter path and file name where the settings ought to be saved.
3. Type command "par".
4. Select Transfer / Capture Text / Stop.
5. You can now edit the settings and upload them back to TC (see chapter 3.2.2).

Printing settings in a text file. (Can be uploaded back to TC if lines containing #A33 are retained).

p a r

An excerpt of the print-out:
#A33 5
#A3 10
etc.

3.2.4 Modem

TC answers to incoming phone calls by default. The incoming phone call is linked to the TC's command interpreter if it is a data call (a call to the TC's data number from fixed telephone network or GSM network) and the unit is in the programming mode. This enables you to send settings in a text file or give commands to your TC one at a time like in the data cable connection.

Command #ON exits the programming mode if there are phone numbers in the phone directory.

3.2.5 Profiles

TC version 4.8 contains two ready-to-use operating profiles to familiarize you with your TC. When the installation is complete, you can activate the desired profile with command #E.

Setting a profile on

E x y

x = Profile number 1 = default settings (see table in chapter 7)
2 = general installation version
3 = Sonera Alerta Service profile

y = Language 1 = Finnish
2 = English
3 = Norwegian

This command causes TC to start using the preconfigured settings already in the unit's storage. You can modify the settings as you wish, but the default settings will always be there in case you need to revert back to them. The person who is installing TC does not have to perform any other additional setup tasks besides adding the GSM SMS service operator's and users' phone numbers in the TC's phone directory.

If you are using profile 2, inputs IN2, IN3 (and IN5, IN6, IN8 in TC84i+) must be short circuited if no sensors are connected to them. This is necessary because profile 2 interprets open contact for these inputs as an alarm.

See separate E2 protile installation example.

3.3 Testing Installation

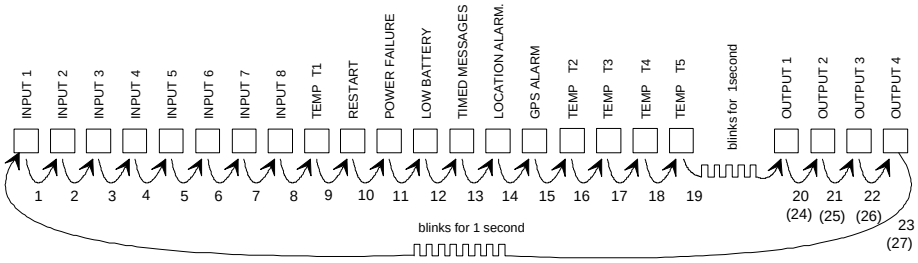
You should make sure that there is just your own phone number in the TC's phone directory when you test the control circuits of the unit in order to avoid confusion among other users. You should test alarms from each sensor you have connected to the unit and send commands to test the outputs. However, before you start testing the installation of TC, you should have your TC print out an installation report. You should go though each alarm channel in the report and verify that the states of the control circuits are as intended (see chapter 3.3.2).

3.3.1 Checking Alarm Channels

You can check the statuses of alarm channels by going though the channels and inspecting the yellow light A. The indicator light A will symbolise the status of the alarm channel 1 after TC is first started up. Indicator light A is further explained in chapter 2.1.1.

Operation switch (6) can be used to browse through the alarm channels. By pressing the operation switch once, light A symbolises the status of the alarm channel 2. By pressing the operation switch

again, light A starts showing the status of the next alarm channel, which is number 3, and so on. When light A is symbolising the status of the alarm channel 19 (last one) and the operation switch is pressed, the yellow light starts blinking rapidly and light A moves on to symbolising the status of the output 1. If a contact is closed, the yellow light A will be on. After the outputs have been skimmed through, the yellow light A starts blinking rapidly and returns to symbolising the status of the alarm channel 1.



Picture. The order in which the statuses of alarm channels and outputs are symbolized by light A. Notice that there can be either four or eight outputs depending on the value of parameter #A42.

Note! This method also reveals the channel specific activation and deactivation times which are symbolised by the indicator light A.

3.3.2 Installation Report

After sensors have been installed, it is important to get some verification that the installation was indeed successful. Command #S5? produces information from which you can see whether the states of alarm channels are as expected.

Printing out installation report

```
#S5?
```

The number of the alarm channel, logical status of the channel at the time of the query (1 = closed contact or 0 = open contact), and the state that triggers off the alarm state in parenthesis are displayed on each line of the installation report. If there are no alarms at the time of the query, the current state and the number signifying active state must be different from each other.

An example print-out:

```
IN1 : 0  (1)
IN2 : 0  (0)    Alarm channel two is in state 0 (open) and alarm state is 0. Alarm is on.
IN3 : 1  (0)
IN4 : 0  (1)    Alarm channel four is in state 0 (open) and alarm state is 1. Alarm is off.
IN5 : 0  (0)
IN6 : 1  (0)    Alarm channel six is in state 1 (closed) and alarm state is 0. Alarm is off.
IN7 : 0  (0)
IN8 : 0  (0)
IN9 : 0  (1)
IN10 : 0  (1)
IN11 : 1  (1)
IN12 : 0  (1)
IN13 : 0  (1)
IN14 : 0  (1)
IN15 : 0  (1)
IN16 : 1  (0)
IN17 : 0  (1)
IN18 : 1  (0)
IN19 : 0  (1)
```

Note that the status is the actual state of the channel at the time of the query. In other words, activation and deactivation times have no effect on the print-out.

Rule of interpretation

If two adjacent numbers are equal, ones or zeroes, there is something wrong with the installation or the settings, or surprisingly enough, the alarm channel in question is currently on.

3.3.3 Status Information

The states of all outputs and alarm channels can be asked with single command **#S1?**.

Asking statuses of alarm channels and outputs

S 1 ?

The above command returns information in the following format:
I1:x I2:x ... I19:x O1:x ... O4:x
x = the state of the alarm channel or output. 0 = off (open) and 1 = on (closed)

The state is 1 when the control circuit is closed (current flows) and 0 when it is open. The active state and activation and deactivation times have no effect on the printed status value. In outputs, state 1 means that the relay is closed and 0 means that the relay is open.

3.3.4 GSM Module Information

The signal strength should be always checked after installation of TC with command **#S2?**. The command displays information about the GSM module, too.

S 2 ?

The command returns:
A6:x SIGLEV:y MODULE:z.
x = start-up counter value
y = signal strength level 0 - 32
z = GSM module type:
3 = Siemens TC35
4 = Siemens TC45

The signal strength level should be at least 10 to guarantee reliable GSM message traffic.

4. BASIC FEATURES

In this section we delve into the settings of alarm channels and the TC's internal phone directory. After the basics we will explain how the operating mode can moderate the sending of alarm messages. At the end of the chapter we will go through the basic settings of TC's outputs and how macro commands can be used to make your life a bit easier.

The alarm messages that TC sends out are formed in so-called alarm channels. When there is an alarm condition in a control circuit, the respective alarm channel immediately forms an alarm message and sends it to the users defined in the phone directory. You can also get status information about alarm channels by making an explicit query at any time.

You can command TC either by GSM Short Messages or by making phone calls to the device. A phone call from a trusted phone number triggers off a preset action. Alarm messages can also include commands.

4.1 Phone Directory

TC requires that its internal phone directory contains at least one phone number in order to function normally. The phone directory is needed in sending alarm messages to the correct phone numbers but also in recognizing who is trying to access the device and with what permissions. There is room for one hundred phone numbers in the directory and each number has a permission level 1 through 4. The default level for all users is 1.

The directory memory cell 0 is reserved for the GSM operator's SMS Service number.

4.1.1 Phone Numbers

When the user wants to modify the settings of TC from his or her mobile phone, that mobile number must be stored in the TC's internal phone directory. If that number does not exist in the directory and the user still wants to use his or her mobile phone, the unit must be switched to programming mode. The programming mode can be turned on by holding the operation switch (6) down for three seconds. The indicator light B will start blinking in red as soon as the unit enters the programming mode. In this mode, the unit accepts all GSM Short Messages from all mobile phones.

You can make setup changes though data cable connection regardless of the operating mode and the GSM connection.

Adding a phone number in the phone directory

P x a a a a a a a b c d

x = directory memory cell (0 – 100)
aa = the mobile number from which the unit intended to be used (the number must be given in the international format, for example, +358nnnnnn if you are in Finland. To find out your country code, send a GSM Short Message to yourself and check the sender information).
b = permission level (not required, default is 1)
c = the number of the macro command to be executed upon phone call (not required)
d = the number of the macro command to be executed upon data call (not required)

If you give number 100 as the parameter d, data calls from this phone number are routed directly to the TC's command interpreter. It is useful to have the number of the person who installed your TC set in this manner so that he or she can make setup changes effortlessly though data connection. If the parameter c is set to 101, the device's operating mode can be switched by a phone call from this particular phone number.

It is advisable to check the contents of the directory after any experiments so that no unwanted numbers remain in the directory. The following commands are used in browsing and editing the numbers in the directory.

Asking the contents of the phone directory

P ?

This will print out the 21 numbers in the directory (P0...P20)

Asking a single phone number

P x ?

x = memory cell number 0 through 100

Asking a single phone number and its macro settings

P x ? ?

x = memory cell number 0 through 100
This will print out the phone number and the allowed macro commands

Removing a phone number

P x

x = memory cell number 0 through 100
This will clear the memory cell x. NOTE: the last and only number must be the cell number!

Checking a range of phone numbers

P 4 5 - 5 6

This will print out the phone numbers from 45 to 56

4.1.2 Permission Levels

Permission level (b) can be assigned to a phone number by appending any number from one to four at the end of the command **#P**. All phone numbers have unlimited access rights (level 1) by default. All phone numbers can receive alarm information irrespective of the permission level.

Level 1: All rights (this level is used if no parameter b is given in the command).

Level 2: Can receive alarms and send commands to set relays on and off. Cannot change device settings.

Level 3: Can only receive alarm messages and execute macro commands with phone calls.

Level 4: Can only receive alarm messages, but macro commands are also available excluding the ones that are executed on phone calls.

4.1.3 Wild-Card Characters

It is possible to use so called wild-card characters in the phone directory. Wild-card characters enable the use of TC even if the phone number is not kept in the directory in its entirety. The following wild-card characters are available:

? matches any digit (exactly one)
***** matches zero or more digits

For example, in command **#P1 +35840123????** the last four (exactly four) numbers can be any digits. Whereas command **#P2 * 2** grants permission level 2 to all phone numbers.

If wild-card characters are used, information security issues must be considered carefully. You should never grant permission level 1 to any number taking advantage of the wild-card characters. It is recommended to use permission level 2 or 4 for these phone number entries. This prevents the modification of the unit's settings from phone numbers that contain wild-card characters.

☞ If a phone number contains wild-card characters, no alarm messages are sent to the numbers matching the pattern.

A hint: The company that performs the installation of your TC can leave their maintenance phone number or their TeleCont phone number in the unit's phone directory. The maintenance worker is able to adjust the settings of the device without being physically present. You can block alarm messages from a phone number by appending the wild-card character * at the end of the phone number.

4.1.4 SMS Service Number

TC automatically uses the SMS service number on the SIM card if there is one, otherwise the SMS service number must be explicitly given with command #P0. If the unit is not responding to your GSM Short Messages, the SMS service number might be missing. You can find out the number from your subscription contract or by calling your operator.

4.2 Alarm Channels

TC sends all alarm messages and automatically generated notifications through so-called alarm channels. There can be as many as 19 alarm channels and each of them reacts to the state of the corresponding input. Alarm channels are as follows:

1...8	control circuits (INPUT) 1...8
9	internal temperature sensor T1
10	unit restart
11	power failure
12	low battery
13	timed messages
14	location alarm
15	GPS alarm
16...19	external temperature sensor T2...T5 or current 1...4

The channel mode defines the way the channel reacts to the changes of state. In the normal mode, the state of the input triggers off or releases an alarm condition. Other modes are event and hour counters. When the channel operates as an event counter, it counts the pulses of the input. In the hour counter mode, the channel counts time always when the input is active. The event and hour counter modes can trigger off alarms by means of alarm threshold values.

State recognizing modes	1 = one-way alarm channel 2 = two-way alarm channel (SMS's are also sent when the alarm goes off) 6 = delayed alarm 9 = like mode 1, but always on (24 h monitoring) 10 = like mode 2, but always on (24 h monitoring)
Event counter modes	3 = event counting 12 = event counting with alarm (see chapter 5.3.1)
Hour counter modes	5 = hour counting 7 = hour counting by subtracting the counter value 8 = hour counting by incrementing the counter value
Special modes	4 = disable mode (see chapter 4.4.1) 13 = operating mode change by pulse

4.2.1 Channel Settings

For each of the alarm channels you intend to employ, you have to define how the alarm channel handles the changes in the state of the input and how the alarm is to be carried out. The settings of an input include the logic for recognizing alarm condition, delays, counters, and the actual alarm message. If the state of an input meets the requirements of an alarm, an alarm message is formed in the channel and sent to the recipients as specified.

Settings for inputs:

#Ix a b c d y channel mode, polarity, delays, and alarm message

#Rx y y.. alarm recipients
#Jx y alarm transfer method

In addition to the above channel specific commands, many global settings affect all channels collectively. Such settings are the alarm expiration time (#A17 x y), removal of prefix from all alarm messages (#A20 x), the number of call retries (#A31 x), the phone call length (#A9 x y), and the device name (#A10 xx).

Changing the channel mode, delay, and alarm message

I x a b c d y y y y y y y y y

x = channel number 1-19
a = operating mode
- 0 = not in use
- 1 = one-way alarm channel
- 2 = two-way alarm channel (SMS's are also sent when the alarm goes off)
- 3 = event counter
- 4 = shunting (see chapter 4.4.1)
- 5 = hour counter
- 6 = delayed alarm
- 7 = hour counting by subtracting the counter value
- 8 = hour counting by incrementing the counter value
- 9 = like mode 1, but always on (24 h monitoring)
- 10 = like mode 2, but always on (24 h monitoring)
- 12 = event counting with alarm (see chapter 5.3.1)
- 13 = operating mode change on activation of the channel (pulse)

b = active state
- 0 = open contact
- 1 = closed contact

c = activation time
- as seconds (0-3000 seconds).

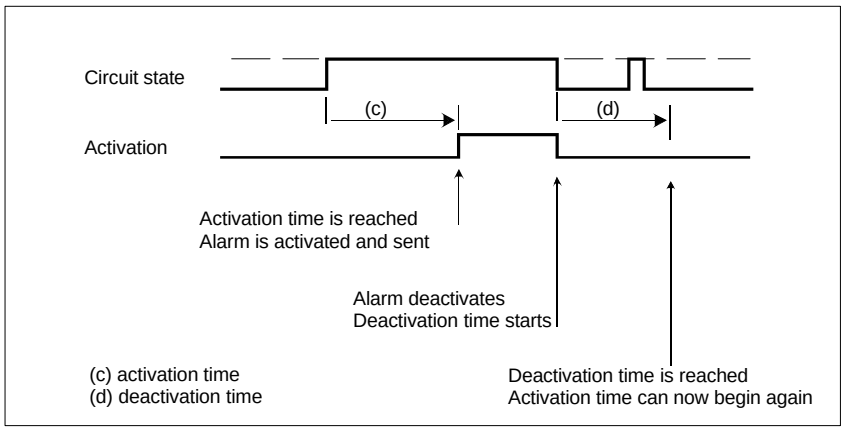
d = deactivation time
- as seconds (0-3000 seconds).

y = free form alarm message
- the maximum length is 160 characters minus the number of characters taken up by the command and its parameters.

For example, command **#I1 1 1 1 25 Alarm 1** modifies the settings of the alarm channel 1 as follows: the channel operates as a one-way alarm channel where closed control circuit signifies an alarm state. Activation time is 1 second and deactivation time is 25 seconds. The alarm message that will be sent out to the users in an alarm state is "Alarm 1".

It is possible to remove the free form alarm message by entering a hyphen (-) in the place of the alarm message. The alarm message still has the fixed prefix **INx:** if it has not been explicitly removed (see chapter 5.5.1) and if the device has not been given a name with command A10 (see chapter 5.5.2). For example, command **#I1 1 1 1 25 -** removes the alarm message set in the previous example.

There are certain differences between the alarm channels; therefore, the reader is encouraged to read carefully the programming and usage details for each of the channel types.



Picture The activation and deactivation times for an alarm channel

4.2.2 Polarity, Activation, and Deactivation

Each alarm channel has five parameters that influence the channel's operation. The **alarm state** parameter determines whether the channel is active when the contact is open or closed. The input must be in the alarm state for as long as is defined by the **activation time** before any alarm messages are sent out. After the alarm messages have been sent, the channel must be in the opposite state for as long as is determined by the **deactivation time** before new alarm can be raised. No new alarm messages are sent if the input returns back to the alarm state before the deactivation time has elapsed.

☞ The alarm channel's event counter is incremented every time the state switches to active even if the channel is not set up as an event counter. The counter is incremented even in disable mode although no alarm messages will be sent.

The activation and deactivation times are also available when the channels operate in event or hour counting modes.

4.2.3 Two-Way Alarm

TC can be programmed to send different GSM Short Messages upon activation and deactivation of an alarm channel. This can be accomplished by dividing the free form alarm message with separating character $ and setting the alarm channel to operating mode 2 (parameter a = 2). The first part of the message is sent upon activation and the second part is sent upon deactivation of the input.

For example: **#I1 2 1 1 25 Alarm 1 on$Alarm 1 off**

In the above example, the alarm channel 1 has been programmed to send an alarm message upon deactivation as well (parameter a = 2). The message that is sent upon deactivation is "Alarm 1 off".

4.2.4 Delayed Alarm

The feature is meant to be used in those alarm channels that are placed in a location with a security keypad for controlling the TC's operating mode. The alarm channel registers the active state quickly, but offers you the opportunity to stop the alarm message from being sent by switching TC to disable mode from the security keypad or by some other means. The sending of the alarm message is postponed for the duration of the deactivation time if the operating mode of the alarm channel is 6. You can switch TC back to normal mode during the deactivation time from the security keypad.

The length of the delay is the same as the deactivation time programmed for the alarm channel. Deactivation time is zero for this channel.

For example: **#I2 6 1 1 25 Alarm**

- alarm channel two has been assigned delayed alarm mode (number 6)
- alarm state is closed contact (alarm state = 1)
- alarm is registered after one second (activation time = 1)
- alarm message is sent after 25 seconds from activation (delay = 25)

4.3 Alarm Messages

This chapter guides you through the alarm settings that determine how and to whom alarm messages are sent. The sending procedure is controlled by the alarm channel settings, alarm transfer method, message routing, and the phone directory. The alarm channel settings determine the actual alarm message and the alarm transfer method (phone call, GSM Short Message, or both). Routing, on the other hand, is used for selecting the end users that will ultimately receive alarm messages in their mobile phones. By default, all alarm messages are routed to all numbers in the phone directory excluding those numbers that contain so-called wild-card characters.

Global settings can be used in constructing certain parts in alarm messages. For example, command #A10 sets a name for the device. The device name is then inserted at the beginning of each alarm message.

4.3.1 Routing

All alarm messages are sent to all phone numbers found in the TC's internal phone directory by default. However, it is possible to route alarm messages from a particular alarm channel to just those phone numbers the user has explicitly chosen with command **#R**. Each alarm channel can have ten different recipients at most.

☞ This feature allows you to determine the phone numbers and the calling order for them in so-called cyclic alarm transfer. The cyclic alarm transfer method is used for calling one person at a time from a list of people.

General format for routing

R x y y y y

x = alarm channel number (1-19)
y = memory cell number in the phone directory (1-100, max 10 phone numbers)

Routing all alarm channels

R * y y y y

* = wild-card character that denotes all channels 1 through 19

Removing routing from a specific channel

R x

x = alarm channel number (1-19) or the wild-card character *, which will remove routing from all alarm channels

4.3.2 Transfer Method

The alarm information can be forwarded as GSM Short Messages, phone calls, or both. Only GSM Short Messages are used by default. When phone calls are used, TC makes phone calls to the numbers found in its internal phone directory in addition to or in replacement of GSM Short Messages. The alarm is acknowledged by answering to the phone call. TC will keep on calling until someone answers to at least one of the phone calls or until the alarm expires (see chapter 4.3.6). You can select your preferred alarm transfer method with command **#J**. Commands #A32, #A17, and #A9 determine the number and the interval between call attempts, the alarm expiration time, and the time used for waiting for someone to pick it up and the time for how long the line is kept open.

Setting the alarm transfer method

J x y

x = alarm channel number 1-19, wild-card character * refers to all channels
y = transfer method:
- 0 = alarm messages are blocked out
- 1 = GSM Short Message
- 2 = phone call
- 3 = GSM Short Message and phone call
- 4 = GSM Short Message and phone call to one number at a time

GSM Short Message and Phone Call

In alarm transfer methods 2 and 3, TC keeps on making phone calls relentlessly until everyone to whom the alarm was routed to has answered to the call. TC cannot distinguish you from your answering machine, and it thinks that it was you who picked up the phone even if were the answering machine. Notification messages from operators (such as "The number you are trying to call cannot be reached…") are not taken as acknowledgements like phone calls picked up by answering machines.

☞ When you are using transfer method 3, make sure that all phone numbers you have programmed to receive alarm messages can be reached! TC will keep on calling to the number even if it is not a valid or a correct phone number. TC will also keep on trying to call to mobile phones until someone answers even if they are out of reach. This continued process of reaching people can somewhat slow down the operation of your TC. The alarm expires after two hours by default (see chapter 4.3.6).

Cyclic GSM Short Message and Phone Call

In this transfer method (4) the alarm message is sent to one person at a time in the same order as the recipients' phone numbers are kept in the phone directory (P1, P2 … P100). If the channel has been routed to particular phone numbers only, the order in which the alarm calls are made is determined by the given routing order. The process of sending alarm messages is abandoned as soon as someone picks up the phone. The sequence is as follows:

- TC sends a GSM Short Message to the first number in the directory (or in the routing list)
- TC makes a phone call to the same number
- if no one answers to the phone call, TC tries again (three times altogether)
- if someone answers to the phone call, no calls are made to the remaining numbers
- if the third attempt to reach the person fails, TC moves on to the next phone number and starts the same procedure over again
- the task is abandoned if nobody answered

Answering Machines

TC waits for your answer for 30 seconds, but the time span can be changed with parameter y in command #A9. The connection is cut off after the specified period has elapsed. By setting the time span shorter than the time it takes for your answering machine to pick up a phone call effectively removes the obvious problem with alarm condition getting acknowledged without your consent (the alarm is acknowledged by the answering machine and not you). For example, set the parameter y to 20 seconds if your answering machine answers to phone calls after 30 seconds (#A9 60 20).

When you pick up the phone, TC sends two signals to alert you that connection has been established.

4.3.3 Timed Messages

Alarm channel 13 allows TC to send messages at certain intervals. The programming of this channel slightly differs from the other alarm channels, but the routing of the alarm messages is similar.

The general pattern for setting the alarm channel 13 parameters

I 1 3 a b c d y y . . y

a = 1 – feature is on
0 – feature is off

b = Message contents. You can select more than one piece of information by summing the selected values together:
1 = counter values
2 = location information (GPS)
4 = temperatures
8 = supply voltage
16 = analogue inputs Y1 ... Y4
32 = states of outputs
64 = device operating mode

c = Interval between messages as minutes

d = Offset (the time after which the first message is sent) as minutes (in reply message this indicates how long it will take until the next message is sent)

yy = Free form message given by the user, the contents of the parameter b are appended at the end of this

If you ask the settings of this channel with command #I13?, the return message contains the programmed information except for variable d that signifies the time after which the next message will be sent out.

For example, the below command will cause TC to send the first message after 60 minutes from the current moment. Messages are then sent once a week. The pieces of information that will be contained in the return messages are the operating mode and the supply voltage 64 + 8 = 72.

#I13 1 72 10080 60 Timed message

Return message will be in the following format: IN13:+ Timed message B:13.5V Security:ON

4.3.4 Attempts in Cyclic Transfer

The number of attempts your TC makes in trying to reach a person in the cyclic transfer mode can be reduced if it is of utmost importance for anyone to know about the alarm condition without unnecessary delay. TC tries to call everyone at least three times by default, but this can be altered with command #A31. The number of attempts must be within one and one hundred.

Setting the number of call attempts

A 3 1 x

x = the number of attempts (1 – 100)

4.3.5 Phone Call Length

Command #A9 is used for determining the time-out that cuts off the connection after the specified period has elapsed. Both incoming and outgoing phone calls have time-outs. Time starts running from the moment the phone is picked up.

A conversation with your TC through data connection usually requires longer phone call length than normally.

Setting the maximum phone call length and the attempt time

A 9 x y

x = phone call maximum length, default is 30 seconds (1...3000 s)
y = the time for how long TC waits for an answer (1...3000 s)

4.3.6 Expiration Time

TC immediately starts counting time when it sends an alarm message or makes an alarm call. The alarm is discarded as obsolete if none of the phone calls were answered within the specified time. The expiration and the retry times can be given with command #A17. The default expiration time is 120 minutes (two hours). For example, expiration might result from GSM network failure as GSM Short Messages do not get through to the end users.

Setting the expiration time and the retry time between phone calls

A 1 7 x y

x = expiration time (1 – 32000 minutes)
y = the time gap between alarm calls (1 – 10 minutes)

This is a global parameter, and as such, it has an effect on all alarm channels in the device. The shortest alarm expiration time is one minute and longest is 32000 minutes (over 22 days). The maximum waiting time between two phone calls is 10 minutes.

4.4 Blocking Alarm Messages

If TC is in the normal operating mode, an alarm message is always sent when an alarm channel becomes active. These alarm messages can be blocked by setting TC to disable mode. Only channels in operating modes 9 or 10 (24h monitoring) can send alarm messages in disable mode.

There several different ways to switch TC from normal to disable mode and vice versa:

- By shunting (=security keypad, one of the control circuits are in operating mode 4 or 13)
- By sending a command (#ON / #OFF)
- By making a phone call. TC lets you know in what mode it will be switched to. One beep means that the monitoring is about to be switched on and a series of two beeps means that the monitoring is about to be switched off.

Any of the above methods can be used in switching TC from disable mode back to normal mode regardless of what method was employed earlier.

However, it is strongly recommended that only one method is preferred over others for consistency.

4.4.1 Changing Operating Mode by Means of an Alarm

You can control the operating mode of your TC from an alarm channel. This feature that involves an input controlling the operating mode of the device is sometimes called as shunting.

When an alarm channel is shunted, the activation of that channel sets TC to disable mode. You can set this feature on with command **#Ix** parameter **a = 4** (see chapter 4.2.1).

For example, if you want to have the alarm channel 1 controlling the operating mode, send the following command to your TC: **#I1 4 1 1 30 yyyy**. The disable mode goes on when the alarm channel has been closed for one second. The unit returns back to the normal mode when the contact 1 has been open for at least 30 seconds.

Any channel that changes the operating mode to disable mode will block all alarm messages from being sent.

TC does not send a message when the disable mode is turned on or off, but it can execute the macro commands as defined with command #A30 at the switch of the operating mode (see chapter 4.4.6).

When TC goes back to normal mode, it does not forward any information about the state changes that occurred during the disable period. Those channels that are in active state during the transition from disable to normal mode will cause alarm messages being sent. Commands for controlling outputs and other features work normally in the disable mode.

As a sign of disable mode the indicator light B blinks in red and green (in normal mode it blinks just in green).

Alarm channels with operating mode 9 or 10 (24h monitoring) cannot be disabled.

#Ix 9 or #Ix 10

Channels that have the above setting can be used, for example, for smoke detectors. It is certain that alarm messages are always sent from these channels regardless of the operating mode.

4.4.2 Operating Mode Change by Pulse

Operating mode can also be changed any time by activating an input. This setup can be accomplished by setting the parameter a to value 13 in command #Ix (see chapter 4.2.1). A device that has gone in disable mode will not automatically revert back to normal mode of operation when the input returns back to open state. The user himself must give a pulse which will cause the normal operating mode to set in after deactivation time elapses.

4.4.3 Perimeter Protection

This feature simply means a certain kind of setup in which you want to have just some of the control circuits on and others off. An example of this would be a situation in which the magnetic switches of the entrance doors to your home need to be in use at night time. This protects your home even though you are sleeping inside.

This feature can well be turned on either by a phone call or a GSM Short Message, but it is recommended that a separate switch or a security keypad is installed and an input is reserved for this purpose. This is not really an operating mode of TC, and therefore you cannot determine whether the feature is on or off simply by looking at the indicator lights or running status queries. A glance at the switch tells you whether the protection is on or off.

For example, the switch that controls the perimeter protection is connected to input IN2. The magnetic switches of the entrance doors are connected to input IN3.

#P20 42
#I2 10 1 2 2 /#I3 9$/#I3 1
#R2 20

The separate switch can now control the state of input 3 (IN3).

4.4.4 Changing Operating Mode with GSM Short Message

TC can also be switched to disable mode with simple command **#off**. TC goes immediately into disable mode and does not send any alarm messages.

On the other hand, command **#on** can be used to set the TC's operating mode back to normal without any delay. Therefore, this command must not be given sooner than the installation personnel have left the monitored location.

Setting disable mode on (alarms are off)

O F F

Setting normal mode on (alarms are on)

O N

As a response to both above commands TC sends out the following information:
TC security: [ON/OFF]
battery: [12.1V]
temp: [25.4C]
location: [GPS coordinates]

4.4.5 Changing Operating Mode with Phone Call

A phone call from a trusted phone number always toggles the unit's operating mode (i.e. the active mode is changed from normal to disable mode and vice versa). You will hear one or two beeps which lets you know in what mode TC will be switched to when you close the phone. One beep means that the monitoring is about to be switched on, and a series of two beeps means that the monitoring is about to be switched off. This behaviour is similar to the logic that is used in many electric locks in modern cars. A car's turn indicators flash once when the locks are closed and twice when the locks are opened.

To enable operating mode change by phone calls, you need to substitute the macro command number with number 101 when adding a new phone number to the phone directory (see 4.1.1). You also need to enable this feature with command **#A8 3**. However, this prevents any other actions controlled by phone calls from working (see chapter 4.8.1).

4.4.6 Relay Signalling Operating Mode and Commands at Mode Change

Any of the four relays of TC can be selected to reflect the operating mode of the device. In disable mode the relay releases and in normal mode it holds.

This allows TC to present the unit's operating mode with signal lights. This feature comes in handy in installations where the TC's operating mode must be changed by using a "hidden switch" instead of a security keypad and when the unit is installed in a place where it cannot be easily seen.

Sometimes it is useful to execute commands in the monitored location at the change of the operating mode. TC can run a predefined macro command when the operating mode changes.

Setting a relay to follow the operating mode changes and macro commands

A 3 0 x y z

x = relay contact used for signalling the operating mode, 1 – 4 or 0 when not used
y = the macro command number to be executed upon entering the normal mode (1-15)
z = the macro command number to be executed upon entering disable mode (1-15)

This feature can be disabled by setting X to zero. You can give the macro commands even if you do not use the relay.

For example, relay 4 can control the water solenoid valve as the operating mode changes:

#A30 0 5 6
#M5 Water off /#O4 1
#M6 Water on /#O4 0

4.4.7 Status Report

Command #? returns a status report that contains important information about the monitored location. If the unit is in disable mode (OFF) and there are people in the monitored premises, it is probable that the status report prints out information about active alarm channels in the alarms field.

Asking the operating mode

?

The above command returns a status report containing the operating mode, battery voltage, temperatures, location information, GSM signal strength, and the active alarms:
TC Security: ON
Battery: 13.5
T1: +28.0
T2: +23.1
T3: -12.2
T4: -67.0
T5: -67.0
Loc:
GSM signal: 26
Alarms:

☞ You can append a question mark at the end of any GSM Short Message which converts the command into a question. For example **#I?** or **#I5?** etc (exception: you cannot append question mark at the end of command E or #CLR.)

☞ Do not type space character before the question mark. For example, command #I ? is interpreted as a command instead of a question, and will not work as such. You will realize this when the response message comes if not sooner.

4.5 Temperature

TC has one internal temperature sensor T1, but it can be furnished with a separate AD-4 conversion card, which can host up to four temperature sensors or four sensors measuring current (T2 – T5) or (Y1 – Y4).

Table Analogue alarm channels.

Sensor	*Alarm channel*	*Physical location*
T1	9	Internal temperature sensor
T2	16	AD-4 conversion card
T3	17	AD-4 conversion card
T4	18	AD-4 conversion card
T5	19	AD-4 conversion card

T1 sensor does not have a feature called hysteresis (the difference in temperature between ON and OFF states) that would prevent redundant alarm messages from being sent when the temperature fluctuates around the set alarm threshold. For this reason, activation and deactivation times for alarm channels 9 should be set long enough to stifle unnecessary alarm messages.

When using an external AD-4 conversion card, the hysteresis is in use on channels 16 through 19 and its default value is two degrees. However, the value can be changed with commands #A25...#A28 (see chapter 5.4.2).

You can ask the temperatures from all sensors with command #T? or from a specific sensor with command #Tx?.

Asking temperature values

T ?

An example print-out from TC with an AD-4 conversion card hosting sensor T3:

T1:+26.0 T3:+24.1

You can also include the alarm threshold values in the print-out. In such case, the first value is the current temperature and the following two values are the upper and lower threshold values that trigger off temperature alarms. If there are no sensors connected to the AD-4 conversion card or the cable is disconnected or broken, the temperature value equals to -67.0.

Asking temperature and alarm threshold values

T ? ?

An example print-out from TC with an AD-4 conversion card hosting sensor T3:

T1:+26.0 -30.0..+50.0 T2:-67.0 -30.0..+50.0 T3:+24.1 +5.0..+50.0 T4:-67.0 -30.0..+50.0 T5:-67.0 -30.0..+50.0

Setting alarm threshold values

T x y y z z n n n

x = the number of the temperature sensor (1 - 5)
yy = lower threshold (default is -30)
zz = upper threshold (default is +50)
nnn = a free-form text explaining where the temperature sensor is located (default is empty)

The threshold values must be given in whole numbers. A negative value can be formed by placing a minus sign in front of the value. The confirmation message received in response to executing this command is the same as in querying the temperature, for example, **T1: +23.5 –10..30.** An alarm message is sent when the temperature surrounding the unit rises above or drops below the set threshold values. Alarm messages are sent at -30 and +50 degrees by default. The free-form text describing the measurement location can be 12 characters long at most.

The alarm channel settings such as the routing of alarm messages, activation and deactivation times, one-way and two-way channel modes, and the free form alarm message can be given in the same manner as with other alarm channels (see chapter 4.2.2). Parameter b must be in its default value of 1 (closed contact).

Example settings for sensors T2 and T3:

#I16 2 1 10 10 Temperature alarm$Temperature OK
#I17 1 1 10 10 Outside temperature

It should be noted that an alarm message is always formed in the alarm channel and sent out by TC when the temperature drops too low or climb too high. If you intend to use the temperature sensor as a thermostat for switching the heating on and off, you have to set the upper threshold value so high that it cannot be reached in normal circumstances.

Example settings for the case described above:

#I16 2 1 10 10 Temperature alarm /#O2 1$Temperature OK /#O2 0
#T3 10 70

4.5.1 Internal Temperature Sensor T1

TC is furnished with one fixed temperature sensor T1 situated in the right bottom corner of the circuit board. It measures temperature from the immediate surroundings of the unit. Querying and setting the alarm threshold values can be accomplished with command **#T1**. The internal temperature sensor T1 uses the alarm channel 9.

☞ Internal temperature sensor T1 can have over ten degrees higher values than an external temperature sensor. This phenomenon occurs because the sensor is placed inside the unit's box where heat is transmitted along the copper layers of the circuit board.

4.5.2 AD-4 Conversion Card

TC can be furnished with an external AD-4 conversion card which must be connected to connector 10 (see chapter 2.1). The card contains four inputs for measuring temperature with NTC sensors or 4-20mA current. The sensors are connected to the card with a twisted paired cable. The external AD-4 conversion card provides alarm channels 16 through 19. You can ask the values of the channels with commands **#Y?** , **#S6?** or **#T?**.

It is possible to select the purpose of each channel individually. You may have to adjust the jumpers on board depending whether you are using the NTC temperature sensors or sensors measuring 4-20mA current. You can connect other temperature sensors, such as PT100, to the card as well, but in that case you have to use a test amplifier and calculate the parameters e and f of commands A25-A28 (see chapter 5.4.1.).

TC notices the AD-4 conversion card and its sensors automatically when it is connected to the unit.

4.5.3 Temperature Sensors T2 – T5

The maximum cable length for NTC temperature sensors is 50 meters (Telemic provides these cables). If the cable needs to be longer that 5 meters and it runs alongside 230V cables, you have to use a shielded cable and the covering must be grounded from the TC's end of the cable. The minus of the power supply (8-30VDC) must also be grounded to the same spot.

The working range for the sensors is from -40 to +70 degrees in Celsius. The main range is from 0 to +20 degrees in Celsius with just one degree tolerance.

Temperature sensors that have been connected to the external AD-4 conversion card have hysteresis of two degrees. However, this default value can be changed if need be. For example, if an alarm message is generated at five degrees above zero, the temperature must rise up to seven degrees above zero before the alarm state becomes deactivated and the message "Temperature OK" is sent (for two-way alarm channels).

The alarm threshold values can be set to the external temperature sensors in the same manner as with sensor T1.

Setting temperature alarm threshold values

T x _ y _ z _ n n n

x = the number of the sensor 2 - 5
y = lower threshold
z = upper threshold
nnn = free-form text (default is empty)

☞ The parameters y and z have the same effect as parameters b and c in commands #A25-#A28. If you want to change the hysteresis of sensor T3 (default is 2 degrees), you have to use command #A26 (see chapter 5.4).

An alarm threshold value can be given with the precision of one decimal, for example, 15.5 degrees.

The default parameter values for commands #A25 - #A28 are suitable for NTC temperature sensors and they need not be changed if you are using NTC temperature sensors.

The values of temperature sensors T2 – T5 can be asked with command **#S6? This prints out the temperatures only.** Command #T?? can be used in printing the alarm threshold values as well. If the temperature is higher or lower than the specified alarm threshold values, an alarm message accompanied by the measured temperature is sent to the recipients.

Asking temperatures

```
# S 6 ?
```

The above command returns data in the following format:
S6:
IN16: 22.0 C
IN17: 23.6 C
IN18: -7.0 C
IN19: -17.0 C

4.6 Outputs

TC has four outputs. Any of these relays can be set closed, opened, or pulsed to the opposite state for 0.1-1000000 seconds (i.e. for 11.5 days). The pulse command is particularly useful for opening electric locks and for resetting various kinds of devices. The pulse command can also be repeated automatically. Then the output will emit a certain number of pulses that have a requested length.

The TC's relay contacts are aimed for low power use only. If the user wishes to control lighting or heating, then he or she must employ an external switch unit. This is equipped with all boxed TCxxB models.

4.6.1 Relay Operating Mode

If parameter #A42 is not set, TC's own low voltage relays work in unison with the external relays on the RE-4 card. They can operate independently if parameter #A42 is set to 1.

Relay operating mode

```
# A 4 2  x
```

x = 0 relays work in unison O1…O4
x = 1 relays work independently O1…O8

4.6.2 Settings

Command **#O** is used for controlling the outputs in TC. The state of an output can be queried either with command **#O?** or, if you want to be more specific, with command **#O1?**. If the command parameter is some other value besides 1 or 0, the command is interpreted as a pulse command. The pulse command can be cancelled by opening or closing the output with command #O.

You can assign a descriptive text to an output by sending a command such as **#O1 Light on $Light off** to TC. The text must not begin with a number or a hyphen and it can contain 20 characters or less. The hyphen clears the free form text you had given to the output. From now on, the text will be included in the confirmation messages, in our example TC would return the message **O1:1! Light on**. This means that you tried to set the output 1 to a state in which it already was (notice the exclamation mark).

Setting relay 1 closed

```
# O x  1
```

Setting an arbitrary text to relay x

```
# O x  L i g h t  o n $ L i g h t  o f f
```

Clearing the arbitrary text from relay x

```
# O x  -
```

4.6.3 Pulsing

For example, if you want to use an output for heating, the output can be pulsed to the opposite state by supplying command **#O1** with a time limit (max 1 000 000 seconds, i.e. 11.5 days) instead of the state information (0 or 1). This ensures that the heating is not forgotten on for too long. If the relay was open before the command was sent, it will be kept closed for as long as was defined in the command, and vice versa

It is also possible to pulse outputs for shorter periods than two seconds. For example, command #O1 05 stands for a pulse that takes half a second. Maximum pulse length is 100 000, if an extra zero is used at the beginning.

If a new pulse command is received during the time TC is still executing a previous pulse command, the new time is added to the remaining time of the first pulse making up the total length of the pulse. The state of the output is left unaltered. For example, if a command sets a relay closed for two minutes, and after one minute another two-minute pulse command is received, the total length of the pulse amounts to three minutes.

The confirmation message received in response to pulsing contains the state of the relay and the remaining time of the pulse. No new confirmation messages are sent when the relay returns to its original state.

The pulse command can be cancelled by sending either command **#O1 0** or **#O1 1** depending on whether the user wants to leave the relay contact open or closed.

☞ To pulse an output for exactly one second, send command #O1 010 to your TC.

Pulsing an output

O x _ y _ z

x = output 1 - 4
y = the length of the ON or OFF pulse (do not use values 0 or 1 in pulsing)
z = the number of pulses 1...1000000 (default is 1)

For example, this feature can be used in a local siren alarm having a distinctive beeping sound for each alarm channel.

4.7 Controlling Heating

TC can keep the temperature at a steady level in the monitored location by means of thermostatic control. You can pick one of the TC's temperature sensors for this task. When the temperature drops below the set limit, TC will start the heater. On the other hand, when the temperature climbs high enough, heating will be switched off. TC checks the temperature once a minute and instructs the heater according to the read temperature.

Setting thermostatic control

A x x _ y _ z _ n n n

xx = 38…41 correspond to the relays 1…4
y = the desired temperature (can be used with a decimal point, for example: 21.5)
nnn = command to turn heating on, for example TEMPERATURE (Note: if you use more than one sensor for thermostatic control, you need to assign unique commands for each of them, for example: ROOM1, CELLAR, etc.)

When you want to disable thermostatic control, just give number 0 as the temperature sensor number, for example **#A38 21 0**. Thermostatic control can be used in four different rooms with differing temperatures.

✋ If thermostatic control is in use, the output dedicated for controlling the heater cannot be commanded with the usual GSM Short Messages or phone calls. Also, 0 is always returned when you ask for the status of a relay (#O?).

✋ You can set alarm threshold limits to sensors that are being used by thermostatic control as usual. An alarm message is sent if the temperure drops too low or climbs too high.

✋ Make sure that the house remains habitable even if TC is removed from the house. It is the room thermostat or battery thermostat that ultimately controls how low temperature can drop. If you spend more time in the house, adjust temperature from the aforementioned thermostats, not from TC.

4.8 Phone Calls

The TC's outputs can also be controlled by phone calls by default. Besides controlling outputs this feature is utilized in switching from one operating mode to another and in making an audio connection to the monitored location. Your phone number must be in the TC's phone directory in the correct format.

☞ In addition to the above, you have to set the parameter x of command #A5 to its default value of zero if you have changed it to one at some point, otherwise you cannot control outputs with phone calls.

A speaker and a microphone are needed in establishing an audio connection between you and TC (sometimes just a microphone is enough).

Determining how incoming phone calls are handled

A 8 x

x = one of the following actions:

- 0 – the call is left unanswered
- 1 – the call is answered (default).
- 2 – the call is answered and command #D is executed with delay (see chapter 5.5.6).
- 3 – the call toggles the TC's operating mode from disable to normal or vice versa (see chapter 4.4.5).
- 4 – the call is answered and data connection is established between you and TC (see chapter 5.6.8).
- 9 – the call is left unanswered but the command specified with #D is executed

If there is number "100" in a phone directory memory cell along with the user's phone number instead of a macro number, phone calls from that particular number will be connected to the TC's command interpreter like data calls. It does not matter what you have specified with command #A8 x.

4.8.1 Macro Command with Phone Call

You can execute a specified macro command with a phone call to the TC's GSM or data number. A phone call to the data number can mean execution of a different command than a phone call to the GSM number. The data number on the TC's SIM card is a service that enables data communication to the subscription. You can assign a macro command to a phone number by appending the macro number (1 – 15) at the end of the permission level in command #P. For example, command **#P3 +358xxxxxxx 1 5 6** means that macro number 5 will be executed on a phone call and macro number 6 on a data call.

Asking the macro commands in the phone directory

P x ? ?

x = the directory memory cell number

Example response:
P3:+358xxxxxxx 1 5 6
This message means that the macro command 5 will be run when the user makes a call to the GSM number. If the user makes a phone call to the data number, macro command 6 will be executed.

If a macro command number for data calls equals to 100, the data calls are connected directly to the TC's command interpreter. For example, **#P3 +358xxxxxxx 1 5 100**. If macro number is 101, phone calls from this number can change the device's operating mode (see chapter 4.1.1).

Relays can also be controlled by using command **#D**, but it is recommended that you start using macro commands as described earlier.

You must issue command **#D** to set the pulse command parameters. After this initial setup, it is possible to pulse an output with simple command **#Dx** without providing the length of the pulse or with a normal phone call to the TC's GSM or DATA number. Every relay contact can have individual pulse command parameters, and all four outputs can react to a same phone call.

For example, if you have two gates that need to be controlled, you can open one gate with a GSM number and the other with a DATA number.

Setting the parameters for controlling outputs with phone calls

D x y z c

x = the number of the relay 1-4
y = 0 = not used
1 = GSM Short Message
2 = phone call to the GSM number or GSM Short Message
3 = phone call to the Data number or GSM Short Message
z = the length of the pulse, may begin with a zero as in command #O (see chapter 4.6.3)
c = the number of pulses (1...1000000)

Pulsing an output with GSM Short Messages, x = output 1-4

D x

Asking the state of an output, x = output 1-4

D x ?

☞ A phone call to the GSM number applies to all outputs with parameter y set to value 2. Whereas a phone call to the DATA number (normal phone call to the data number on the TC's SIM card) applies to all outputs with parameter y set to value 3.

The following commands must also be executed in order to allow outputs to be controlled with phone calls: #**A5 = 0** (see chapter 5.5.4) and #**A8 = 1** (see chapter 4.7). You do not have to execute these commands if you have not touched the parameters.

The example command sequence below illustrates how to set the output 1 to execute a pulse that takes five seconds on a phone call from any number to the TC's GSM number. Output two will give four twenty second pulses upon reception of a phone call to its DATA number.

#P9 * 2	all phone numbers are granted permission level 2
#D1 2 5	a call to the GSM number causes the output 1 to emit a five-second pulse
#D2 3 20 4	a call to the DATA number causes the output 2 to emit four twenty-second pulses

The phone directory must contain the phone numbers from where this feature is to be used. In the above example, the wild-card character * in the directory memory cell 9 grants execution rights (permission level 2) to all phone numbers. There are differences between operators in how A-numbers (caller) are sent, therefore the wild-card character * can be turn out to be useful in testing and experimenting.

☞ If you intend to control relays with phone calls, TC must receive your phone number along with the phone call. The number can be in the international or national format depending on the operator.

No GSM Short Messages can be sent from the phone numbers that have been given in the national format. A-number is always sent in the international format in GSM Short Messages. If the user wants to send GSM Short Messages, his or her phone number must be given in the international format in the phone directory. It should be noted that TC considers this number a new user and if alarm messages are not routed, the user will receive all alarm messages twice. The best practice to avoid this mishap is to append the wild-card character * at the end of the international formatted number (see chapter 4.1.3).

4.8.2 Disabling Confirmation Messages

The confirmation messages for output commands can be disabled with command #A7. For example, it might be necessary to disable confirmation messages in cases where your TC controls another TC. This prevents unnecessary GSM Short Messages from being sent.

Confirmation messages are also pointless in situations where the user eyewitnesses the action him or herself. For example, opening of a gate is a response in itself.

Disabling confirmation messages

A 7 x

x = 0 – confirmation messages off
1 - confirmation messages on (default)

4.9 Executing Commands on Alarms

You can instruct TC to run commands when an alarm is raised. You just have to replace the free form text in the alarm message with the commands you want to your TC to execute. This feature comes in handy, for example, in situations where an alarm message from a humidity detector closes the water solenoid valve and causes an alarm siren to go on.

4.9.1 Internal Messages

Number 42 has a special meaning when it is found from the TC's internal phone directory. If an alarm message is to be forwarded to number 42, it will not be sent out as an ordinary GSM Short Message, but instead it will be transferred directly to the TC's command interpreter. TC will see the alarm message as an incoming command string and it will perform any commands that it might contain.

Setting the special number 42 in the phone directory

P x 4 2

This feature enables your TC to open or close relay contacts on the request of the generated alarm message. For example, a local alarm siren and a water solenoid valve might be wired to a relay contact that is controlled with internal messages.

☞ If the number 42 is in any of the memory cells in the phone directory, the alarm message is always transferred to the command interpreter first and then routed to the actual phone numbers.

4.9.2 Local Alarm Siren

A local alarm siren can be programmed go on, for example, when the alarm channel 3 becomes active. After the following commands have been executed the output 2 is ready to emit fifteen two-second pulses when the channel 3 becomes active.

#I3 1 1 1 10 Alarm /#O2 2 15	command **#O2 2 15** is included in the alarm message
#P20 42	number 42 is inserted into directory memory cell 20

☞ TC always removes the slash from the command in the confirmation message.

4.9.3 TC Controlling another Unit

As we have learned so far, alarm messages can contain commands that TC eventually executes. If this kind of message is sent to another TC, the commands are parsed and executed. The command must be somewhere in the free form alarm message and it must begin with character / (i.e. **/#xxx**, where xxx stands for the command). For example, there could be information concerning the alarm channel itself at the beginning of the message and then the command that needs to be executed

An example on how to program the controlling TC's inputs:

#I1 1 1 1 10 Pressure lower limit /#O1 1 The pressure sensor in input 1 will turn the pump on

#I2 1 1 1 10 Pressure upper limit /#O1 0 The pressure sensor in input 2 will turn the pump off

The same result can be achieved through one single channel by defining it a two-way alarm channel.

#I2 2 1 1 10 Pressure lower limit /#O1 1$Pressure upper limit /#O1 0

These commands can be routed to several phone numbers (mobile phones too), should it be necessary to monitor the behaviour of a simple pressure control during a test period. It is worthwhile to switch off the confirmation messages from the receiving TC with command #A7 0.

4.10 Macro Commands

It is possible to group several commands under one descriptive title. This enables you to control your TC with the least effort. For example, if you have installed TC in your home, you can define two simple macro commands for controlling the TC's operating mode depending whether you are at home or not. After you have specified the macro commands, you can use your TC with the following commands:

#HOME or
#AWAY

Up to fifteen different macro commands can be programmed into TC. Each command can be assigned a unique title which can be twenty characters long at most. These macro titles are case-insensitive (i.e. upper and lower case characters can be user interchangeably). You can chain commands together in as long as there are less than 40 characters. The command chain must begin and end with character /.

Macro commands present a powerful method for granting limited permission rights to some users. Permission level 4 allows the user to receive alarm messages and to use specified macro commands (see chapter 4.1.2).

Programming a macro command chain

M x y y y / # O 1 5 # T ? /

x = macro command number (1...15)
yyy = the title of the command (max 20 characters)
/#O1.. = the actual commands (max 40 characters)

Do not combine many #M commands in one GSM Short Message. Create only one macro command chain at a time.

For example, if the user has sent command **#M1 Heating on /#O1 1#S6?/** to his or her TC, it can be used in the following manner:

Using the example macro command

H e a t i n g o n

This command causes the relay 1 to hold. The received confirmation message will also contain the temperatures from sensors T2 through T5.

Deleting macro command number x

M x -

The title that you give to a macro command must not already exist in the TC's instruction set. You cannot insert a macro command inside another macro command.

5. ADVANCED FEATURES

The settings and commands that enable TC to be used in even greater variety of application domains are outlined in this section. Some of the features presented here require deeper insight into the operation of TC. Therefore, the following pages should be read carefully if you intend to use the advanced features TC has to offer.

5.1 Logs

TC keeps track of the ten latest alarm messages it has sent out. The received commands are also stored in a separate log. The logs are stored in non-volatile memory so the entries will not be lost at power failures. You can track down ten latest alarm messages and commands at most just by reading the logs.

5.1.1 Alarm Log

The alarm log stores ten latest alarm messages automatically. You check what and where alarm messages have been sent with command #K? or #Kx?. Character x equals to the number of the queried command starting from the most recent one. For example, number one will print out the latest alarm message, number two will print out the last but one, and number ten will print out the oldest alarm message in the alarm log.

Printing out all entries in alarm log (max 10 entries)

K ?

Printing out alarm log entry x

K x ?

The above command returns data in the following format:
K1: x , y , z , nnnnnn
K1 = the most recent alarm message (K1 – K10)
x = alarm transfer method
1 – GSM Short Message
2 – phone call
4 – cyclic alarm transfer
y = the number of the alarm channel responsible for the alarm (1 – 19)
z = state of the input 1 = alarm went on 0 = alarm went off
nn = the phone number where the message was sent

The alarm log will contain only those alarm messages that TC has been able to forward. TC will not make a log entry if sending of a GSM Short Message to SMS Service fails, or no one answers to the phone call in cyclic alarm transfer method. When the alarm condition is brought to the attention of the user by means of a phone call, the log entry will also tell who picked up the phone.

5.1.2 Command Log

You can easily find out what the ten latest executed commands and their senders were from the command log. The log entries can be printed out by sending either command **#L?** or command **#Lx?** to TC. Character x stands for the number of the asked command starting with the most recent one. For example, number one will print out the latest log entry (the command you just sent), number two will print out the last but one, and number ten will print out the oldest log entry available

Printing out all entries in command log (max 10 entries)

L ?

Printing out command log entry x

L x ?

The above command returns:
L1: +358xxxxx y:#L? L2: +358xx etc...
L1: the latest command (L1 – L10)
+358xxx y: the sender's phone number and permission level
#L? the last received command
L2: the last received command but one, etc…

If a command has been sent from your computer to TC through serial connection, the log entry will contain text "LOCAL 1" instead of a phone number. An internal command is printed out like the rest of the commands and it can be recognized from number 42.

5.2 Start-up and Power Failures

5.2.1 Restart Message

TC can send a restart message when the power is switched on although this feature is not enabled by default (a = 0).

Setting the restart message on

I 10 a 1 c d yy . . y

a, c, d, and yyy have the same functions as in other alarm channels

5.2.2 Start-up Counter

TC has an internal start-up counter that is incremented by one every time the power is switched on. The value of the counter can be asked with command #A6? and it can be reset to zero with command #A6 0

Asking the start-up counter value

A 6 ?

Resetting the start-up counter to zero

A 6 0

5.2.3 Disable Period at Start-up

Some sensors need a period of settling down when they are switched back on after power failure. Unnecessary alarm messages might be generated if the sensors react too fast in testing environments or in installations with no battery back-up. In these cases, it is reasonable to keep TC disabled for some time after the power is switched back on.

You can decide the length of the disable period with command #A19. The time must be given as seconds. It defaults to ten seconds, while maximum value is 600 seconds (= 10 minutes).

Setting a thirty-second disable period

A 19 30

5.2.4 Batteries and Supply Voltage

TC is capable of measuring its own supply voltage. Measuring supply voltage is quite useful in situations where TC is used with battery back-up. You can receive an alarm message if the mains voltage is lost or when the battery voltage is getting too low. TC can also shut itself down if the battery voltage drops too low.

Setting the alarm threshold values for supply voltage

B x y z

x =	power failure alarm threshold	8.0 – 30.0 V (default 12.7V)
y =	low voltage alarm threshold	8.0 – 30.0 V (default 11.5V)
z =	threshold for shutting TC down	8.0 – 30.0 V (default 10.5V)

Asking the supply voltage and the threshold values

B ?

The above command returns:
B:12.0V 12.7V 11.5V 10.5V
The first value indicates the supply voltage at the moment and the rest three values are the alarm threshold values programmed with command #B.

Power Failure

A power failure message is sent when the supply voltage drops below the value set with parameter x in command #B. The power failure alarm uses the alarm channel 11.

I 1 1 a 1 c d yyy..y

a, c, d, and yyy have the same functions as in other alarm channels

In the case of a power failure, TC appends the measured supply voltage at the end of the alarm message. TC exits the alarm state when the supply voltage has risen at least 0.5V above the set low voltage alarm threshold.

Power failure alarm requires battery back-up so that the alarm message can be sent even when the battery voltage has dropped below the threshold limit (default 12.7V). Depending on the size and charge of the battery an alarm message is delayed by five to twenty minutes so that minute power failures are filtered out. If even small power failures ought to be recognized, the parameter x of command #B must be set so that the alarm message is sent immediately when the voltage of the battery charger drops, for example, from 13.5 volts down to 13 volts.

Low Voltage

Alarm message concerning low voltage is sent when the supply voltage falls below the threshold value set with the parameter y of command #B. The alarm message is formed in alarm channel 12.

I 1 2 a 1 c d yyy..y

a, c, d, and yyy have the same functions as in other alarm channels

The actual supply voltage is appended at the end of the alarm message. TC exits the alarm state when the voltage rises at least 0.5V above the set threshold limit.

Shut Down

TC will shut down if the supply voltage drops below the limit set with the parameter z of command #B. No alarm messages are sent on shut down.

After shut down TC will continue to check the supply voltage once a second and TC will switch itself back on when the supply voltage rises about one volt above the threshold value (default: 10.5V + 1V = 11.5V). A restart message is sent (alarm channel 10) if it has been explicitly enabled (see chapter 5.2.1).

5.3 Counters

Every alarm channel has its own counter. Every time an alarm channel gets activated, the respective counter is stepped up by one. When an alarm channel is solely used for counting you have to set the channel to the counting mode (3). In this particular mode of operation, activations of the alarm channel do not entice any alarm messages, but instead the counter is incremented by one at each activation. It is advisable to set the activation and deactivation times to zero if the channel is intended to be used in counting mode. This speeds up the counting and it can be as fast as 50 steps in a second.

The current counter values can be printed out with command **#C?**. The values can also be retrieved counter by counter with command **#C1?**. A seed value can be given to each counter and it must be between zero and the maximum value of 4 294 967 295. The default seed value is zero.

Setting a zero seed value to counter x

C x 0

The counter will overflow back to zero after it has passed the maximum number 4 294 967 295.

☞ Each and every alarm channel has exactly one counter. The same counter is used for both hour and event counting. The maximum value for hour counting is the same as for event counting (i.e. 4 294 967 295 seconds).

5.3.1 Event Counter Alarms

Any alarm channel can be programmed to operate as an alarming event counter. The alarm threshold limit can be set with command CAx y and an alarm message is sent when the counter exceeds the given limit. No new alarm messages can be sent from the alarm channel unless a new alarm threshold limit is given with command #CAx y or the counter is reset with command Cx 0.

Setting a channel to operate as an alarming event counter

I x 1 2 B c d y y . . y

b, c, d, and yyy have the same functions as in other alarm channels

Setting an alarm threshold limit for a counter

C A x y

x = alarm channel number
y = alarm threshold limit (1 – 4 294 967 295)

You can ask a counter value with command #Cx?. The counter's alarm threshold value can be asked with command #CA?

The following commands achieve a setup in which the event counter sends a notification message after 10 events have been executed and resets the counter to zero.

#CA1 10
#I1 12 1 1 1 Door opened 10 times /#C1 0
#P20 42

5.3.2 Fast Counters IN7 and IN8

Inputs IN7 and IN8 are capable of counting 1000Hz pulses. These counters have an adjustable prescaler and a value scaler.

Setting prescaler values

A 3 2 x y

x or y = 0 inputs IN7 or IN8 operate normally
x or y >= 1 fast counter is in use and x or y is the value for the prescaler (max 30000)

You can set the fast counting mode on with command **#A32 x y**. Parameter x sets the mode for the input IN7 and y sets the mode for the input IN8.

When you want to know the counter value with command #Cx?, the displayed value is the result of dividing the number of received pulses with the prescaler. In other words, if the prescaler is 5 then the counter value will be 1 after five pulses.

You can set a value scaler with command **#A35 x y**. Parameter x sets the scaler for the input IN7 and y sets the scaler for the input IN8. The scaler can turn a counter value into a more readable decimal number, for example, the number of pulses can be converted into kilometres. There can be three decimal digits after the dot at most and the scaler and prescaler can be in use simultaneously.

Setting a scaler value

A 3 5 x y

The scaler is in use if the value is not equal to zero
The scaler value can be anywhere between 0.001 – 100000, for example 0.123

Notice that the scaler also divides the alarm threshold value given with command #CA. For example, if you want to receive an alarm message when the counter reaches 2345.6 and you have set the scaler to 10, then the alarm threshold limit must be 23456. The threshold value must be given in the same units as the counter is printed.

5.3.3 Hour Counter

Every alarm channel can be set to operate as an hour counter with alarm messages. The counter counts time as seconds when the alarm channel is active instead of counting events. This mode can be activated by setting the alarm channel mode to hour counting (set the command #I parameter a to 5, 7, or 8).

Table Alarm channel hour counting modes

Mode	*Counting behaviour*	*Alarm threshold*	*Available commands*
5	counts seconds by incrementing the counter value	not available	the value can be set and asked with command #C
7	counts hours by subtracting the counter value	at zero	the time can be set and asked with command #H
8	counts hours by incrementing the counter value	can be set with command #G	the time can be set and asked with command #H

Counting Seconds

You cannot receive an alarm message from a channel that counts time as seconds. You can merely ask the current counter value with the following command:

Asking the counter value

C x ?

This command returns the counter value as seconds

Hour Counting by Subtracting Counter Value

If an alarm channel is in the operating mode 7, the counter value is subtracted every second when the channel is active. In this mode, however, the values of hour counters can be treated as hours even though the counter itself counts seconds starting from the given seed value. When the counter reaches the zero, an appropriate alarm message is sent. After the message is sent, the counting will continue to negative values. When the user asks the value of the counter, it will be presented as hours.

Setting the seed value for hour counting

H x y

x = alarm channel number
y = the new seed value with at least one decimal

For example, commands **#Hx 0.1** and **#Hx 123456** are both legal seed values. The seed value can be given as hours with the precision of one decimal. The maximum value is 1193046.4 hours (about 136 years).

Asking a counter value

H x ?

The above command returns something similar to the following:
Hx:123.456
which means that there are 123.456 hours remaining before an alarm is triggered off or
Hx:-2.57
which means that 2.57 hours have passed since TC sent an alarm message.

Hour Counting by Incrementing Counter Value

In operating mode 8 the alarm channel counts hours. The counter itself counts seconds from the given seed value. When the counter reaches the set threshold value, a channel specific alarm message will be sent. The counting continues normally after TC has sent the alarm message. When you request the value of the counter, it will be given as hours with the precision of three decimals.

Setting an alarm threshold limit for an hour counter

G x y

x = alarm channel number
y = the alarm threshold value in hours (can be given with the precision of one decimal)

You can set the alarm threshold values for hour counting with the above command. When the counter reaches the threshold value, an alarm message will be sent. The time limit for triggering off an alarm can be entered in whole or decimal numbers (with the precision of on decimal).

5.3.4 Automatic Reset

Any of the TC's alarm channels can be programmed to work as an hour counter that in the case of an alarm sends a message, resets itself, and starts counting again from the seed value.

This feature takes advantage of the possibility that you can insert commands in internal alarm messages. The following example command sequence can be applied to many situations.

#I3 8 1 1 1 Two hours passed /#H3 0

Alarm channel 3 is an hour counter that increments the counter value. Time runs when the alarm channel is closed.

#G3 2	The alarm threshold limit for the channel is 2 hours. There is also command /#H3 0 in the alarm message which is used for resetting the counter at the time of the alarm.
#R3 2 20	Alarm messages are routed to the phone numbers in directory memory cells 2 and 20.
#P20 42	The special number 42 has been inserted into the phone directory memory cell 20 which means that TC sends the alarm message to itself internally and executes command /#H3 0

This behaviour is particularly useful in many cases where maintenance of devices must be performed regularly after a certain number of usage hours have passed. This is also useful for controlling the usage hours of rented devices.

5.3.5 Saving Counter Values

Event and hour counter values are saved into non-volatile memory at regular intervals as determined with command **#A3**. The interval must be given as minutes, and it defaults to 10 minutes. The maximum value is 32000 minutes.

Setting the saving interval to 60 minutes

```
# A 3  6 0
```

5.4 Measuring 4 - 20 mA Current

You must adjust the jumpers on the AD-4 conversion card to enable measurement of current (see the back of this manual: "External AD-4 Conversion Card") and connect the current circuit to the input in question. First you have to calculate the parameters needed for the measurement as shown below. This example uses the PT100 sensor for the measurement of temperature but the same formula can be applied to other quantities as well.

5.4.1 Angular Coefficient and Offset

The measurement values on the external AD-4 conversion card are whole numbers from 0 to 1023. **4mA** equals to **197** and **20mA** equals to **983** on the converter. The values are converted to the desired units with the help of the following linear equation:

y = ex + f
where
y = the quantity measured
x = AD-converter value
e = angular coefficient
f = offset

to find out the variable e: e = (quantity [20mA] – quantity [4mA]) / 786
to find out the variable f: f = quantity [4mA] - e * 197

For example, temperature value 0 on the PT100 sensor corresponds to 4mA and temperature value 150 corresponds to 20mA:

e = (150 – 0) / 786 = 0.1908
f = 0 – 0.1908 * 197 = - 37.595

The values can be set with parameters e and f in command #A.

5.4.2 Settings for Measuring 4 – 20 mA Current

You can modify the settings of the AD-4 conversion card with commands **#A25, #A26, #A27, #A28**.

Setting alarm threshold limits

A x x a b c d e f g

xx = the number of the parameter 25 -28
a = operation: 1 - temperature, 2 – 4-20mA current, 0 – test use (default is 1)
b = lower alarm threshold value (default is -30)
c = upper alarm threshold value (default is 50)
d = hysteresis (default is 2)
e = angular coefficient, sensor specific quantity (see chapter 5.4.1, default is 3892)
f = offset, sensor specific quantity (see chapter. 5.4.1, default is 10000)
g = the unit of the quantity, for example: C, mA, Kg,.. (default is C)

You can find out the AD-converter value by setting the channel mode (parameter a) to zero with commands #A25 - #A28. When you receive the value in response to commands #Y1 - #Y4, the current value from the AD-converter will be displayed.

Asking for a value from an analogue input

Y x ?

x = the number of the input 1-4

The response will be printed in the format:
Y1: x.x uu
x.x equals to the measured value and uu will be replaced with the unit of measurement

The measurement values can be printed out with commands **#Y?** or **#Yn?** (n=1-4). TC will send the values to you automatically if the measured value drops below or climbs above the set threshold value. The measured value is appended at the end of the alarm message.

Displaying the measurement values from sensors

S 6 ?

The above command returns the measurement values from channels 16 through 19:
IN16: x.x uu
IN17: x.x uu
IN18: x.x uu
IN19: x.x uu
where
x.x = the measured value
uu = the unit

☞ You can also print out the values from the NTC sensors with command #S6?. The return message contains temperatures from sensors T2 – T5 without the alarm threshold values. The reading of the message is easier, particularly on small mobile phone displays, if the threshold values are not includes as with command #T?.

5.4.3 Quantity

Quantity is the result of what is being calculated, whereas the unit of measurement is what qualifies the result. For example, 1.5 meters equals to 1.5 x 1 meter. In this case, the meter is the unit of measurement and it can be set with the parameter g in commands #A25 - #A28.

5.5 GSM Traffic Settings

5.5.1 Prefix INx:+/-

In addition to the alarm channel number, every alarm message contains information about whether the alarm state has been activated (+) or deactivated (-). You have the option of removing this prefix if you prefer not have it in the alarm messages.

Setting the use of prefix on (default)

A 2 0 1

Setting the use of prefix off

A 2 0 0

5.5.2 Device Name

TC can include the name of the device at the beginning of all alarm and automatic messages. This prefix can also be used in directing alarm messages to special services provided by the operator. These special services are different from operator to operator, and therefore their availability should be checked beforehand. For example, there could be services for directing alarm messages to your telefax machine. The prefix can be as long as 20 characters.

Assigning a name to the device

A 1 0 y y y

yy = the device name

Removing the name

A 1 0

If you decide to combine several commands in one GSM Short Message and you want to remove the device name, you have to place command #A10 last because otherwise the device name will be changed to whatever comes after #A10.

5.5.3 Outgoing Messages Quota

Command **#A4** sets an upper limit for the number of GSM Short Messages TC is allowed to send daily. This prevents GSM Short Messages from being sent if, for example, the alarm source malfunctions for some reason. The default is 100 and the maximum is 32000 GSM Short Messages in a day. In addition, the total number of sent GSM Short Messages and made phone calls can be reset with this command.

Limiting TC's GSM Short Messages

A 4 x y z

x = The maximum number of GSM Short Messages per day (24 hours)
y = Seed value for the total number of sent GSM Short Messages
z = Seed value for the total number of made phone calls

TC will receive and execute commands normally even if the allowed daily quota of GSM Short Messages has been consumed. However, TC will not send any confirmation messages in response to the commands it receives. Set the daily quota large enough if you are not getting any confirmation messages to your commands. Set the quota back to its original value after 24 hours when the GSM Short Message counter has been reset.

Printing counter values

A 4 ?

x = The maximum number of GSM Short Messages per day (24 hours)
y = How many GSM Short Messages have been sent in total
z = How many phone calls have been made in total

5.5.4 Incoming Messages Cache

TC scans the modem's incoming messages cache for new GSM Short Messages every 60 seconds by default. If the scan is run more often, it will prevent the GSM modem from receiving phone calls. Fortunately, keeping the scanning gap at 60 seconds does not have a negative effect on the handling of incoming GSM Short Messages because the GSM module will inform TC about all incoming messages as soon as they arrive. However, there are certain occasions when this information might be ignored by TC. This will result in a 60 minute delay for the handling of the commands in that particular GSM Short Message. Setting the fast scanning mode on (#A5 1) ensures quick handling of the sent commands if you do not intend to control outputs with phone calls.

Setting the scanning speed at 60 seconds (default)

```
#A5 0
```

Switching the fast scanning on

```
#A5 1
```

5.5.5 Delayed Saving of Parameters

TC stores the given parameters in non-volatile memory immediately at the execution of a command. This default behaviour must be delayed before you can upload a setup file to your TC with data cable or data connection. This can be accomplished by including command #A33 x on the first row in the setup file. The behaviour is restored to its original state with command #A33 0 on the last line of the setup file.

```
#A33 x
```

X = the delay in saving parameters 0 – 5 min

5.5.6 Delayed Phone Call Control

The behaviour described in this chapter is used in conjunction with some commercial services offered by various operators. There are some cases in which the connection must be on for a certain period of time before the caller can be serviced. In these cases, it is necessary to delay the phone call control. The delay can be set with commands #A8 and #A9.

Delaying the phone call control

```
#A8 2
```

Setting the delay at 20 seconds

```
#A9 20
```

For example:

#A8 2 sets the delay on
#A9 20 sets the delay at 20 seconds
#A5 0 allows quicker response

In the above example, the connection must be on for at least 20 seconds before the commands specified with #D are executed. If the connection is cut off before the commands were executed, next incoming phone call will pick up from where the previous phone call left. For example, two phone calls taking fifteen and five seconds respectively will execute the commands (5 + 15 = 20).

5.5.7 Expiration of Commands

In certain cases it is of utmost importance that a command that TC has received too late is not executed at all. These unfortunate delays can be caused by problems in the SMS service or GSM connection, among other things.

TC has a mechanism for abandoning ALL obsolete commands. The only command that always gets through is #A11, which is used in manipulating this feature. Your TC might not operate at all if you instruct it to abandon commands too hastily.

This feature can be taken into use with command #A11. The first parameter in this command tells the time span during which a sent command must be received or it will be discarded altogether. In addition to the time span, the command also includes information about how often TC is to synchronize its internal clock with the SMS service's time. TC synchronizes its clock by sending a GSM Short Message to itself and parsing the time from the message. **The synchronizing of time increases GSM traffic expenses in relation to how often the synchronizing is to be performed.** TC needs to have its own number in the phone directory in any directory memory cell from 1 to 100 in order to send GSM Short Messages to itself.

Setting the expiration time

A 1 1 x y z

x = the maximum time difference between the time stamp of the GSM Short Message and the TC's internal clock
y = how often TC needs to synchronize its internal clock with the SMS Service's clock. The interval must be given as minutes, 10080 minutes is recommended (one week)
z = the directory memory cell with TC's own phone number (1...100)

This feature can be disabled by setting the parameters x, y, and z to zeroes and by removing the TC's phone number from the phone directory.

NOTE! Be careful when setting the parameters with command #A11 because erroneous values can cause unpleasant surprises in the form of soaring GSM traffic expenses.

If it takes longer for a GSM Short Message to arrive at TC than you have specified, TC will not execute the included commands at all. TC will send out message "Command expired: xx yy" (xx = received commands and yy = the time for how long it took to receive the message) instead.

Asking current time

W ?

The above command displays the time of your TC:
TIME: 12:32:49

Synchronizing the TC's internal clock

W

☞ The SMS services may have different times depending on what countries they are located in. This may cause problems if TC is used from a subscription in another country. TC does not have its internal clock enabled unless you explicitly start using it with command #A11.

5.5.8 Message ID

The TC's commands can have an optional message ID. The ID cannot be longer that five characters. This ID is always returned in the confirmation messages in its entirety. You can easily associate the received confirmation messages with their command counterparts. The message ID can contain both numbers and letters, and it must always **begin with character &**. For example, question **&12345#T1?** returns **&12345 T1:+27.0 -30..+28** .

If the confirmation message is too long to fit into one single GSM Short Message, TC will append character + at the end of the message ID.

5.5.9 Passage Control

In many passage control solutions it is often important to know who have entered through the gate controlled by TC and when. The feature described below enables TC to send the entering person's phone number (if the gate is opened by making a phone call) to the TeleCont application or a mobile phone. The relay controlling the gate must also be connected to an input in TC. When a person opens the gate, TC sends an internal log query to number 42 in the phone directory and routes the confirmation message to those phone numbers specified with command #A29. The free form text in the alarm message must be replaced with the log query.

Setting the recipients of confirmation messages

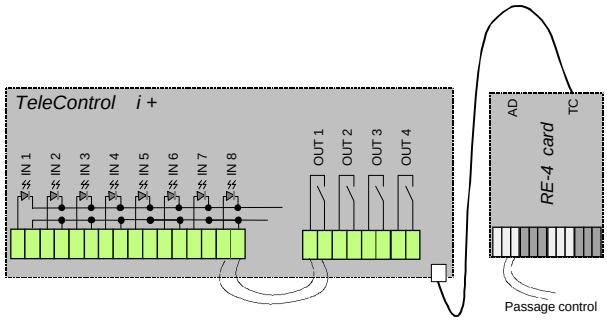
A 2 9 x x x

x = the number of the phone directory memory cell (max 10).
This feature can be disabled by setting x to 0

The following command sequence can be used in setting up passage control. The phone call control must be set as instructed in chapter **Virhe. Viitteen lähdettä ei löytynyt.** so that an incoming phone call controls the relay 1. The power relay on RE-4 relay card controls the gate and the low-power relay short circuits the input 8.

#D1 2 5 1	Sets the relay 1 to be controlled with phone calls.
#I8 1 1 2 2 /#L2?	Alarm channel 8 is assigned an alarm message with an embedded command to send the last but one entry (2) from the command log to you.
#R8 20	Routes the alarm messages from channel 8 to the directory memory cell 20.
#P20 42	Sets number 42 in the directory memory cell 20. Alarm messages routed to number 42 are processed as internal messages and are not sent out.
#A29 1	Selects the phone directory memory cell to which the confirmation messages to internal messages are sent. In this imaginary example, the TeleCont application phone number is in the memory cell 1.
#A7 0	Disables the normal confirmation messages.

After the above settings have been sent to TC, TeleCont starts receiving the people's phone numbers whenever they open or close the gate with phone calls.



Picture Passage control setup

The time for how long the gate is allowed be open can be controlled by using contacts in the latch. For example, set the activation time for the alarm channel 1 to three minutes. If the gate is kept open for more than three minutes, you will receive an alarm message.

#I1 2 1 180 5 Gate left open $ Gate closed OK	two-way alarm channel, closing contact
#R1 1	routes the confirmation message to TeleCont

5.5.10 Status Messages

The feature described here is used heavily in monitoring solutions that involve the use of the TeleCont application.

Normally when an alarm channel shifts into an active state, TC sends either an alarm message or makes a phone call. This alarm message can be replaced with a status message that contains the states of all alarm channels and outputs. The status message sending can be delayed by 1-30000 seconds. The time starts running at the first change in an alarm channel. The status message is sent to the phone numbers given with command R10 x x x.

The status message is not sent in disable mode.

This feature is introduced by setting the selected alarm channels into counting mode. The selected alarm channels form a group in which the first state change sends the status message. In addition, it is necessary to set the parameters of command #A12 as follows:

Setting the delay and the type for the status message

A 1 2 x x y

xx = the length of delay from the first state change to the actual sending of the status message. The delay must be given as seconds from 1 to 30000. Zero means that the feature is turned off
y = the type of the status message

Status message types:

1 = I1 x I2 x I3 x I4 x I5 x . . . I18 x I19 x O1 y O2 y O3 y O4 y

x = the state of the alarm channel
y = the state of the output

2 = INx:+ I1 y I2 y I3 y I4 y I5 y . . . I18 y I19 y O1 z O2 z O3 z O4 z

x = the number of the alarm channel that was activated first
y = the state of the alarm channel
z = the state of the output

3 = INx:+ yyyyyyyyyyyyyyyyyy zzzz

x = the number of the alarm channel that was activated first
y = alarm channel state 1 or 0
z = output state 1 or 0

5.5.11 GSM Connection and Signal Strength

TC is capable of alerting you if there is something wrong with its GSM connection. Among the plausible causes for the problem might be too weak signal strength, damaged antenna, or data connection break-down between your TC and the GSM module.

The alarm threshold value for the signal strength and the output for the alarm can both be given with command #A22. By default, the alarm is off.

Setting the local alarm on

A 2 2 x y

x = the minimum signal strength (1...32)
y = the output for the alarm (1...4)

Setting the local alarm off

A 2 2 0

☞ The output (1-4) that has been selected with the parameter y in command #A22 cannot be used for any other purpose if you decide to use local alarm. Among other things, the output will ignore all commands beginning with #O.

The relay holds and releases according to the signal strength information received from the GSM module. This information is read every five minutes, which means that the local alarm can wait for five minutes (from the moment the problem was first introduced) before it goes on.

In start-up the relay holds until the GSM module has joined the GSM network and the signal strength information is available. This takes approximately half a minute.

5.5.12 Microphone Volume

The volume level for audio connection can be adjusted with command #A24. The volume level has been set to 1 by default, but it can be modified to any other legal value from 0 to 7. Increase by one equals to 6dB increase in volume.

Setting the volume level

A 2 4 n

n = volume level (0...7)

An audio connection is established in alarm calls and it is cut off after 30 seconds by default. You can set the duration of the call with command #A9.

You have to allow incoming calls with commands #A8 1 and #A5 0.

5.5.13 TeliaSonera Alerta Service (Finland and Sweden)

You can set the parameters for Alerta service with profile command #E3 1. In some cases, you might want to sign in the service without changing the channel specific settings. You must use command #A34 in these situations.

Signing in Alerta service

A 3 4 1

Signing out of Alerta service

A 3 4 0

After you sign out, TC will adopt the settings (phone directory, routing, etc…) you had before you signed in the service.

For more information about Alerta service, please visit TeliaSonera web site.

5.5.14 GSM Network Parameters

Printing out the GSM network parameters

S 3 ?

TC displays the following GSM network parameters:

- MCC / MNC Country code / Operator code
- LAC Location area code
- CI Cell id
- SIGLEV Signal level (Rx Lev)
- CHAN GSM channel
- IMEI IMEI code

5.5.15 Neighbouring Cells

TC queries the GSM module for information about the neighbouring cells in the GSM network every five minutes and saves the received information in memory. Command #S4? displays information about the six neighbouring cells.

Printing out information about neighbouring cells

S 4 ?

Excerpt of the print-out:

- CHAN [1] RxLev MCC/MNC
- . . .
- CHAN [6] RxLev MCC/MNC

5.5.16 Software Version

Asking the TC's software version number

V ?

The above question returns:
V:TCnnn Ver x.y.z Mmm dd yyyy ggggggg

TCnnn	= TC model (TC42i+, TC84i+)
Ver. x.y.z	= software version number
Mmm	= the release month
dd	= the release day
yyyy	= the release year
ggggggg	= GSM modem type and software version

An example response: **TC84i+ Ver. 4.7.0 Apr 8 2005 (TC35i 04.00)**

5.5.17 Clearing Alarm Buffer

TC lines up simultaneous alarms in an alarm buffer, and sends them out one by one in first-in-first-out fashion as fast as the GSM network is capable of transferring them. Sometimes you might want to clear the buffer to prevent pending alarm messages from being sent.

Clearing the alarm buffer

C L R

No response message is sent from this command.

5.6 Serial Connection

TC has a serial port through which it can be connected to external devices. This enables TC to function as a modem that can be only accessed from the trusted phone numbers kept in the TC's internal phone directory. The serial connection does not use the so-called hand shaking signals. Only incoming and outgoing data and ground signals are transmitted.

Notice that the connector includes the unit's supply voltage 8 – 30 VDC and 5 VDC. Do not connect cables that you are unfamiliar with to the serial port (connector 1).

Selecting the operating mode for the serial port

A 1 5 x

x is one of the values in the table

Table The operating mode of the serial port

X	*Mode*	*Availability*
0	Not used	TC84
1	GPS reception	TC84
2	Through switched data connection	TC84
3	Data-to-SMS / SMS-to-Data	TC84
4	Data-to-SMS (see chapter 5.6.4)	TC84
5	"AT-modem" (see chapter 5.6.6)	TC84
6	HyperTerminal connection (default)	TC42 and TC84

5.6.1 Bit Rate

Setting the bit rate for the serial port (default 9600)

A 1 4 1 2 0 0

In the above example, the bit rate has been set to 1200. Other valid bit rates are 300, 600, 1200, 2400, 4800 and 9600 bits/s.

5.6.2 Through Switched Data Connection

The serial port can be used only from one application at a time. You can set this feature on with command #A15 2.

If you set parameter x to value 2 (through switched data connection), the incoming call is answered and all data received from the modem is transferred to the serial connection. Correspondingly, all data incoming from the serial port is transferred to the modem.

The incoming data stream from the modem is scanned for the string “NO CARRIER<CR><LF>”, which is taken as an indication of remote hang-up. The time-out given with command #A9 is used for local hang-up.

An example of how to enable this feature:

#A5 0 #A8 1 #A15 2 #A9 3000 #A14 9600

☞ Command #A15 2 disables the phone call control of outputs.

5.6.3 SMS to Data

You can enable this option with command #A15 2. The text entered after command **#F** is sent to the serial port in its entirety.

Sending text to the serial port

F t t t t t t t t . . t

tt..t = the text to the serial port (may contain spaces)

5.6.4 Data to SMS

There exist two methods for converting incoming serial data into GSM Short Messages:

1. The first character of serial data triggers time-out, during which TC waits for the terminating character (#A15 3).
2. The reception of serial data starts at a certain character, and a GSM Short Message is formed from the received data after time-out (#A15 4).

Terminating Character Sending

All data received through the serial port is forwarded as alarm messages as is the case with the activation of an alarm channel. If the received data exceeds 130 characters, the message is truncated to fit into those 130 characters. The message is sent when the terminating character is encountered in the data.

TC will not send the message if the terminating character is not encountered within the specified time.

After TC has received data through the serial connection and the terminating character has been scanned within the programmed time limit, it will send the data as a GSM Short Message to the phone number in directory memory cell 1.

The message can be sent to more than one person by using the phone numbers programmed to alarm channel 14.

For example:

#R14 2 3 4 5

This setup causes the received data to be sent as GSM Short Messages to phone numbers in directory memory cells 2 to 5.

If no terminating character is found from the data within the required time, the received data is discarded altogether.

Setting the terminating character and time-out

A 1 6 a b c d

a = the decimal value of the terminating character
b = time-out (1...600 seconds)
c = the minimum number of characters (1...155) NOT USED
d = terminating character in what TC sends

Command **#A14 2400 #A15 3 #A16 10 5 10 13** sets the serial connection bit rate to 2400 and mode to 3. A five second time-out is launched on the first received character. If the terminating character <LF> (10 as decimal) is received within the five second time-out, a GSM Short Message is formed from the received data and sent to the number in the directory memory cell 1 (or whatever is set up for channel 14) terminating character being <CR> (13 as decimal).

For example, if TC receives the following message within the time-out: **1234567890<LF>**
It will send the following text in a GSM Short Message: **1234567890<CR>**

Starting Character and Time-out Sending

In this mode, TC starts gathering data from the serial port as soon as it has received the programmed starting character. TC accepts at least as many characters as was defined by the user, after which there must be a pause of programmed length in the data stream.

Setting the starting character and time-out

A 1 6 a b c

a = the decimal value of the starting character
b = time-out (1...600 seconds)
c = the minimum number of characters (1...155)

#A14 2400#A15 4#A16 42 5 10

In the above example, the serial port is set at 2400 bits/s and assigned mode 4. TC waits for the starting character * (asterisk, 42 as decimal) which triggers off the reception of data of at least ten characters. If

TC has received enough characters and there has been a pause of five seconds, TC creates a GSM Short Message from the received data and sends it to the number in the phone directory memory cell 1.

NOTE! TC inserts a space at the beginning of the GSM Short Message

If the received data is: ***1234567890**
The outgoing GSM Short Message will be (after 5 seconds): **<space>*1234567890**

5.6.5 Serial Port Time-Out

If you use TC as an "AT-modem" (A15=5) the connection is cut off after the time you have chosen. If the time gap between received characters is too long, the connection will be closed. The time-out can be given with command #A18.

Setting the serial port time-out (default is 60 s)

#A18 600

Asking the time-out

#A18?

5.6.6 AT-Modem

You can set your TC to function like a GSM terminal unit by setting the parameter a of command #A15 to 5. When TC is operating in this mode, it can be connected to water, gas, and electricity meters, to mention a few.

You can use the TC's GSM modem for incoming and outgoing data calls.

Initialization

TC normally uses its own settings with its GSM modem. However, you may want to have the modem operating differently when you use it as a GSM terminal. For example, you may want to disable the echoing of characters on the screen.

You can initialize the modem by giving it an initialisation string with command #A23. This initialisation string is always sent to the modem when command **#A15 5** is executed.

Giving the modem initialization string

#A23 nnnnnnnn

nnnnn = the modem initialization string (max 30 characters)

For example, command **#A23 ATE0** disables the echoing of characters on the screen.

Adoption

You can start using your TC as an AT-modem by sending the commands sequence:

#A15 5#A14 9600#A18 60#A5 0#A8 1

A15 5	AT modem
A14	Bit rate
A18	Serial port time-out 10..32000 seconds, defaults to 60
A5 0	Slows down the polling of the GSM modem (default)
A8	Enables incoming phone calls (default)
A23	Modem initialization commands

Outgoing Direction

When TC notices an incoming character in the serial port, it builds up a tunnel between the serial connection and the GSM modem. The tunnel is torn down if no new characters are received within the specified period of time (the time-out can be given with command #A18).

Incoming Direction

A tunnel between the serial connection and the TC's GSM modem is built up when TC receives a phone call from a trusted phone number if the parameter a of command A15 is set to 5. The tunnel is dismantled after the time set with command #A18 has elapsed and no more characters are received.

5.6.7 HyperTerminal Connection

In serial port mode 6 (#A15 6) you can send commands from you computer to your TC by connecting a data cable between them. The data transfer has the following attributes:

- bit rate: 9600 bits/s
- data: 8 bits
- no parity
- no hand-shake

TC has the default setting of A15 = 6, therefore commands can be given through serial connection in as soon as TC has power switched on.

Same commands work equally well from command prompt as from mobile phones. For example:

```
TC> #T1?
T1:+27.5  -30..+50
```

5.6.8 Commands through GSM modem

TC can also be used through the GSM modem. This is possible if your own modem calls to the TC's phone number which establishes a data connection to the TC's command interpreter.

Note! This feature disables the phone call control if you have programmed it with command #D.

To establish a data connection you need to send the following two commands to TC:

Enabling answering to an incoming call and data connection

```
#A8 4
```

Slowing down the scanning of incoming GSM Short Messages cache (default)

```
#A5 0
```

In addition, it should be remembered that the call must be made from a phone number that is kept in the TC's internal phone directory.

☞ If you have assigned 100 to a phone number as the macro command number, an incoming data call is switched directly to the TC's command interpreter regardless of the parameter x (1 – 9) in command #A8.

5.6.9 Global Positioning System

Any GPS device emitting data in accordance with NMEA-0183 standard can be connected to the TC's serial port.

GPS information can be queried with commands N1, N2, or N3. GPS information can also be included into the messages that TC sends automatically. The GPS information can also be used in location alarms. An alarm message will be sent if TC is taken away from its circular home territory.

GPS Information

Command #N1? retrieves the latest coordinates of your TC.

Asking the coordinates:

N 1 ?

The printing format is as follows:
N1:hh:mm.ss Ndd mm.mmmm Eddd mm.mmmm

hh	=	hours/GMT
mm	=	minutes/GMT
ss	=	seconds/GMT
N/S/E/W	=	hemisphere
Dd	=	degrees of coordinates
mm.mmmm	=	minutes of coordinates

Command #N2 can be used for querying the latest GPRMC field that is in accordance with NMEA-0183 standard.

Asking the NMEA information

N 2 ?

The format:
N2: $GPRMC,….

Command #N3 instructs TC to send GPS information at regular intervals. You can define the interval and the number of messages in the command.

Setting the continuous location information on

N 3 x y

x = the interval as minutes (1 - 30000)
y = the number of GSM Short Messages to send (1 - 30000)

The format of the response is similar to the command #N1 response.

Location Alarm

A location alarm message is sent if TC is taken away from its home territory. The size of the home territory (=circle radius) can be defined with command #A21. The home territory is always recalculated when your TC switches from disable to the normal operating mode.

Directing location alarm to alarm channel 14

I 1 4 a b c d y y y . . . y

a = 0 – not in use
1 – in use
2 – two-way alarm channel
b = 0 – entering the home territory
1 – exiting the home territory
c = activation time
d = deactivation time
yy = your free form text (default: "Location alarm")

The location is appended at the end of the user defined text in the format **N 60.23.22,3 E 26.50.10,0**.

In order to generate a location alarm message, TC needs to know the size of its home territory. This size can be adjusted with command #A21. The size must be entered in meters and it equals to a radius of a circle. The centre of the circle is always calculated when TC switches from disable to normal mode.

Setting the home territory

A 2 1 x

x = circle radius in meters, max 30.000m

Due to the accuracy of GPS, it is not advisable to use a radius less than one hundred meters. Setting the radius too small can trigger off unnecessary location alarm messages.

The alarm channel 15 will send a GPS alarm message if GPS cannot contact the satellites or the data transfer between GPS and TC does not work.

Programming the alarm channel 15

I 15 a b c d yy . . y

a = 0 – off
1 – on
2 – two-way alarm channel
b = 0 – opening information
1 – closing information
c = activation time
d = deactivation time
yy = your free form text (default is "Gps error")

TC will send information about the cause of the alarm: **nav-warning** or **rs232 connection fault.**

Benefon ESC

TC can recognize three commands that comply with the MPTP (Mobile Phone Telematics Protocol) specification version 1.2. With these two commands you can monitor the location and possible movements of your TC on a map on an ESC mobile phone display.

Querying the location of your TC

?LOC

Setting the tracing of your TC on

?TRC x y

x = the interval between messages as minutes
y = the number of messages to send

Cancelling tracing

?STO

6. TROUBLE SHOOTING

If TC fails to function properly, please go through the steps in the table below. Description of the problem is printed in bold letters. The first column offers a solution to the problem, and the second column describes the correct behaviour when everything is ok.

The rightmost indicator light (B) is off:

Switch power on.	The light blinks in red or green.
Check fuses and polarity of the power supply.	

The phone call does not get connected to the device:

Check whether PIN code is on in the SIM card. Remove the PIN code from the SIM card by using your own mobile phone.	TC responds with a beep.
Make sure the GSM subscription in question has been opened. Check the TC's phone number. You must not insert the SIM card in TC when it is on. Switch TC off and insert the SIM card. After the card is in place, you can swicth power back on.	

The unit closes the call immediately without answer:

Make sure your TC has the caller's phone number in its internal phone directory.	TC answers to the phone call.

The indicator light B is red:

GSM connection is missing. Check antenna and SIM card.	The light blinks in green (or red if programming mode is on).

TC does not receive commands:

SIM card's PIN code of the GSM module must be disabled.	The light blinks rapidly for a short while after a GSM Short Message is sent.
Check TC's phone number.	

TC receives commands but it does not reply with confirmation messages:

Insert the user's phone number in the TC's internal phone directory. Only those GSM Short Messages that are sent from trusted phone numbers are processed.	TC returns a confirmation message.
Insert your operator's SMS service number to the phone directory memory cell 0.	TC returns a confirmation message.
The maximum number of GSM Short Messages TC is can send daily has been consumed. See command #A4. The SIM card has a limit for how many messages can be sent. Your mobile phone's memory is full of SMS messages.	TC returns a confirmation message.

TC does not send alarm messages:

Insert the recipient's phone number in the phone directory.	Alarm message is sent.
The alarm channel has been routed to an empty directory memory cell, or the phone number in the memory cell in question contains wild card characters.	Alarm message is sent.
Chech whether the unit is in normal or disable mode. Some alarms are sent only in normal mode.	

The unit only alarms with phone calls:

Set the GSM Short Message Service phone number to directory memory cell 0.	Alarm is also sent as a text message.

There is no phone number displayed in my mobile phone when TC calls me:

TC's GSM subscription might have the sending of its phone number prohibited.	You mobile phone can show you who is calling.

TC does not send alarm messages even if your phone number is in the directory:

Verify that the state becomes active in the alarm channel. Check the unit's operating mode.	Select the channel in question by pressing the operation switch as many times as is necessary. The yellow light will be on in active state.

No changes in relays:

Insert your number in the phone directory. Only those commands coming from trusted phone numbers are run.	Relay contact switches from one state to another and TC sends a confirmation message.
Verify that the syntax of the command is correct. Verify that the user has adequate permissions.	

Alarm is sent every time monitoring is switched on:

An alarm is on for some reason. Check the wires of the alarming sensor. The settings for the alarm channel are wrong. Check whether it is normally closed or normally open control circuit.	Alarm is not sent.

7. COMMAND SUMMARY AND DEFAULTS

Profile 1 is activated when TC is switched on from the operation switch or when someone issues command #E1. The phone directory is cleared when the unit is restarted from the operation switch. Command #E1 restores the default parameter values as described below but it does not clear the phone directory.

Command		Default value
#?	Asking the TC's operating mode **You can append a question mark after any command if you just want to know the current value instead of assigning it a new value (exceptions: #E and #CLR commands)**	
#A3 x	The interval for saving counter values x = time gap as minutes	 10 minutes
#A4 x y z	The maximum number of GSM Short Messages TC can send daily x = the number of messages per day y = reset the number of GSM Short Messages sent z = reset the number of phone calls made	 100 messages 0 0
#A5 x	The interval for checking for new GSM Short Messages x = 0 slow, 1 fast	 0 (slow)
#A6 x	Start-up counter x = seed value	 0
#A7 x	Confirmation messages x = 1 on, 0 off	 1 (on)
#A8 x	Answering to incoming calls x = 0 off, 1 on, 2 on and command #D is executed with delay, 3 operating mode change, 4 data connection, 9 #D without answer	1 (on)
#A9 x y	Phone call duration and waiting time x = maximum phone call length [s] y = time to wait for an answer [s]	 30 seconds 30 seconds
#A10 xx	Device name, prefix for alarm messages (used in some operator services) xx = the alarm message prefix, max 20 characters	(empty)
#A11 x y z	GSM Short Message expiration time x = maximum time gap [s] y = how often TC checks its time [min] z = the directory memory cell with TC's own phone number	 0 (off) 0 1
#A12 x y	Replaces the alarm message with a status message x = the delay from state change to the sending of the status message [s] y = status message type	 0 (off) 1
#A14 x	Serial port bit rate x = bit rate 300,..9600	 9600
#A15 x	Serial port mode x = 1 gps, 2 through switched, 3 data/sms, 4 data/sms, 5 at-modem, 6 HyperTerminal	 6 (cable connection)
#A16 a b c d	The serial port Data / SMS parameters a = the starting or terminating character [decimal] b = the message or character time-out [s] c = the minimum number of characters 1..155 d = terminating character in what TC sends	 10 (LF) 10 s 130 13 (CR)
#A17 x y	Alarm message expiration time x = expiration time [min] y = time gap for phone calls [min]	 120 min 1 min

Command	Default value
#A18 x Time-out for serial port mode 5 x = time-out [s]	 60 s
#A19 x Disable period after TC is switched on x = disable period 0..600 [s]	 0
#A20 x Prefix INx: in alarm messages x = 0 off, 1 on	 1 (on)
#A21 x TC's home territory x = circle radius [m]	 200 m (on)
#A22 x y GSM connection control x = signal strength alarm threshold, 1..32 y = output for the alarm, 1..4	 0 0
#A23 y An installation string for the serial port mode 5 y = the characters to the GSM modem, max 30 characters	 (empty)
#A24 x Microphone volume level x = volume level, 0..7	 1
#Ax a b c d e f g Parameters for the AD-4 conversion card, **x = 25..28** x = parameters 25..28 refer to alarm channels 16..19 a = 1 temperature, 2 current, 0 test b = lower alarm threshold c = upper alarm threshold d = hysteresis e = angular coefficient f = offset g = the unit of measurement for example. C, mA, Kg	 1 –30.0 50.0 2.0 3892.000 (NTC) 10000.000 (NTC) C
#A29 x x Routing of internal command responses (commands TC has received through number 42) x = the phone directory memory cell, max 10 numbers	 0
#A30 x y z Operating mode information from a relay x = the number of the relay, 1-4 or 0 y = the macro command to run on switch to normal mode z = the macro command to run on switch to disable mode	 0 0 0
#A31 x The number of call attempts in one number in cyclic alarm transfer x = the number of attempts, 1-100	 3
#A32 x y Settings for fast counters IN7 and IN8 x or y = 0 = inputs work normally x or y = 1 = fast counter, prescaler is 1 x or y = >1 = fast counter, prescaler is the provided value	 0 (normal) 0 (normal)
#A33 x Delaying parameter saving x = the delay 0..5 [min]	 0
#A34 x Alerta service x = 1 joined in Alerta service, 0 not joined	 0
#A35 x y Scaling for fast counters IN7 and IN8 (max 30000) x or y = 0 = inputs work normally x or y = 1 = fast counter, prescaler is 1 x or y = >1 = fast counter, prescaler is the provided value	 0 (not in use) 0 (not in use)
#A37 x y z Sonera Alerta service settings x = this has a special meaning in the service y = this has a special meaning in the service z = this has a special meaning in the service	 x = +358404080 y = +358179999 z = 0179999
#Ax y z nnn Thermostatic control **x = 38…41** y = desired temperature (can contain decimal point, e.g. 21.5) z = used temperature sensor number 1…5 nnn = command for setting temperature	 0 0
#A42 x Operating mode for relays on RE-4 card and low voltage relays x = 0 relays work in unison, 1 relays work individually	 0

Command		Default value
#B x y z	The alarm threshold values for supply voltage	
	x = power failure alarm threshold [V]	12,7
	y = low voltage alarm threshold [V]	11,5
	z = shut down threshold [V]	10,5
#Cx y	Event counter	
	x = alarm channel number 1..19	
	y = counter value	
#CAx y	Alarm threshold for the event counter	
	x = alarm channel number 1..19	
	y = alarm threshold value 1..4 294 967 259	
#CLR	Clears the pending alarms in the alarm buffer	
#Dx y z c	Phone call control	
	x = the number of the relay 1..4 (1..8 if #A42 is set to 1)	
	y = 0 not in use, 1 sms, 2 sms or phone call, 3 sms or data call	0 (empty)
	z = pulse length	0
	c = the number of pulses	1
#Dx	Executes the programmed pulse command in output x	
#Ex y	Profiles	
	x = profile number 1..3	1 (defaults)
	y = language 1 Finnish, 2 English, 3 Norwegian	1 (Finnish)
#F	SMS-to-Text command	
#Gx y	Alarm threshold value for an hour counter	
	x = alarm channel 1..19	
	y = hours, you can give the value with one decimal	
#Hx y	Hour counter	
	x = alarm channel 1..19	
	y = hours, you can give the value with one decimal	
#Ix a b c d yy	Parameters for channels 1-8	
	x = channel 1..8	
	a = operating mode	1 (one-way)
	b = alarm state, 0 opening, 1 closing	1 (closing)
	c = activation time 0..3000 [s]	1
	d = deactivation time 0..3000 [s]	10
	yy = text	Alarm x
#I9 a b c d yy	Parameters for alarm channel 9 (temperature T1)	
	parameters like in other alarm channels	0 1 1 3000 Temp al.
#I10 a b c d yy	Parameters for alarm channel 10 (Restart)	
	parameters like in other alarm channels	0 1 20 60 Restart
#I11 a b c d yy	Parameters for alarm channel 11 (supply voltage)	
	parameters like in other alarm channels	0 1 10 60 Power failure
#I12 a b c d yy	Parameters for alarm channel 12 (low voltage)	
	parameters like in other alarm channels	0 1 10 60 Low voltage
#I13 a b c d yy	Parameters for alarm channel 13 (timed messages)	
	a = 0 not in use, 1 in use	0
	b = the information in the message 1,2,4,8,16,32,64	1
	c = interval as minutes	3600
	d = the offset before the first message is sent out as minutes	0
	yy = text	Report
#I14 a b c d yy	Parameters for alarm channel 14 (GPS)	
	a = 0 not in use, 1 in use, 2 two-way	0
	b = 0 enters home territory, 1 exits home territory	1
	c = activation time	1
	d = deactivation time	60
	yy = text	Location alarm

Command	Default value
#I15 a b c d yy Parameters for alarm channel 15 (gps error) a = 0 not in use, 1 in use, 2 two-way b = 0 normally closed, 1 normally open c = activation time d = deactivation time yy = text	 0 1 1 60 GPS error:
#I16 a b c d yy Parameters for alarm channel 16 (T2 or AD-4) parameters like in other alarm channels	 0 1 1 3000 Temp al. 2
#Jx y Channel specific alarm transfer method x = channel number or wild-card character * y = method: 0 = blocked 1 = GSM Short Message 2 = phone call 3 = GSM Short Message + phone call 4 = cyclic GSM Short Messages + phone calls	 1
#K? Displays entries in the alarm log	
#L? Displays entries in the command log	
#Mx y z Macro commands (max 15) x = command reference number 1..15 y = name of the command z = the contents of the macro command started with a slash, max 40 characters	 (empty)
#Ox 0|1 Opens or closes the output x = output 1..4 0 opens, 1 closes	 0
#Ox y z Pulses the output x = output 1..4 y = 2..1000000 seconds or 0,1..0,9 seconds (leading zero) z = the number of pulses 1..1000000	 1
#Ox y$z Setting text to an output x = output 1..8 y = the text when the output is on, must not begin with a number or a hyphen z = the text when the output is off (voluntary, leave $ out)	 (empty)
#ON A switch from disable to normal operating mode	
#OFF A switch from normal to disable operating mode	
PAR Prints all TC's settings to HyperTerminal program	
#P? Displays the phone numbers from the directory memory cells 0–20	
#Px-y? Displays the phone numbers from memory cells x through y x and y = 1...100	
#Px a b c d Inserts a phone number in the directory x = memory cell number 0..100 a = the phone number of the subscription that is used for sending and receiving messages from TC b = permission level c = the macro command number to be run on phone call d = the macro command number to be run on data call	 (the directory is empty) 1 (empty) (empty)
#Px Clears the directory memory cell x (x = 0..100)	

Command		Default value
#Rx y y ..	Routing (routes the alarm message to the specified directory memory cells) x = the alarm channel number (1-19), or wild-card character * y = the directory memory cell number, max 10 (1-100)	 (empty)
#S1?	Displays the states of outputs and inputs	
#S2?	Displays the GSM signal strength level and the GSM module type	
#S3?	Displays GSM network parameters	
#S4?	Displays information about the neighbouring GSM cells (6)	
#S5?	Installation report	
#S6?	Displays the temperature or values from sensors measuring current without the threshold limits	
#T?	Displays temperature values	
#T??	Displays temperatures and their alarm threshold values	
#Tn x y z	Alarm threshold values for temperature sensors n = sensor number 1..5 x = lower alarm threshold y = upper alarm threshold z = free-form text	 (on all sensors) -30 C +50 C
#V?	Displays the TC's software version number	
#Y	Reads values from the sensors measuring current	
#W	Checks and synchronizes time	
?LOC	Sends location information in the ESC format	
?TRC	Traces location information in the ESC format	
?STO	Quits tracing set with command ?TRC	

8. TECHNICAL SPECIFICATIONS

Dimensions:	140 x 90 x 38 mm
Weight:	ca 260 g
Current consumption:	at idle 40 - 100 mA / 12 V
	maximum 500 mA
TCi+ supply voltage:	8 - 30 V
	Molex Mini-fit junior connector
Serial port:	RJ-8
Audio port:	RJ-6
AD-4 / RE-4 connector	RJ-4
Maximum values for outputs:	power 30 W
	current 0.5 A
	voltage 50 V
Inputs:	min. control circuit current 3,5mA/12V
	max control circuit resistance ca 30kohm / 12V
Operating conditions:	-20…+50 °C
GSM module:	Siemens TC35
SIM card:	small, 3V
Antenna:	dual-band (900/1800), SMA connector

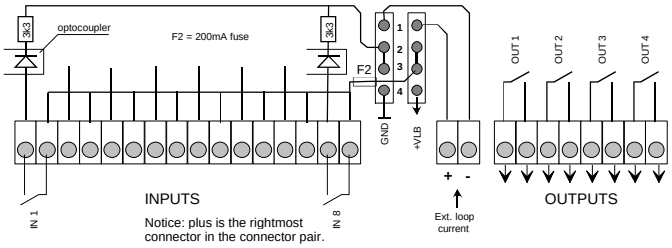
The unit is not protected against water or any liquids.

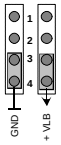
Note! Even though TC uses supply voltage from 8 to 30VDC, please, keep in mind that external devices (such as motion detectors) might not tolerate such high voltages.

Technical specifications are subject to change without prior notice.

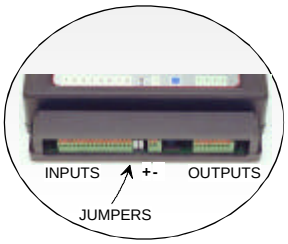
8.1 Control Circuit Connections

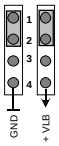
TC has eight inputs for external sensors. The current in the circuit is about 3.5mA at 12V.





Power supply for control circuits from internal power supply 12V (VLB)



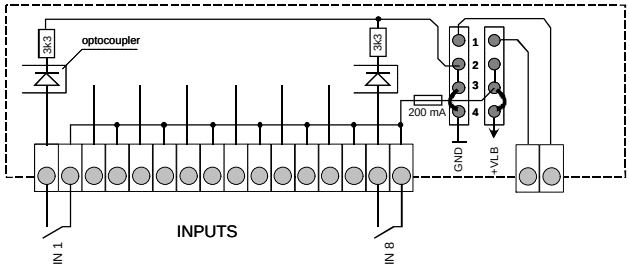


For external supply, adjust the jumpers as shown here

An external power supply for 5 - 25 VDC circuits is recommended if the circuits are long. Ground the minus of the power supply!

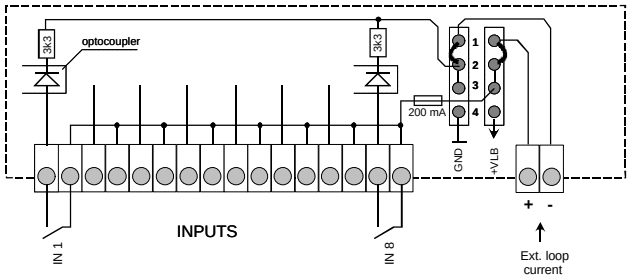
BASIC SETUP

TC's inputs are meant for ON/OFF contacts with jumpers 3-4.



Notice that the rightmost connector is attached to the plus sign of the supply voltage (+8..+30 VDC), be careful not to cause a short circuit even though the connector is protected with a 200mA automatic fuse.

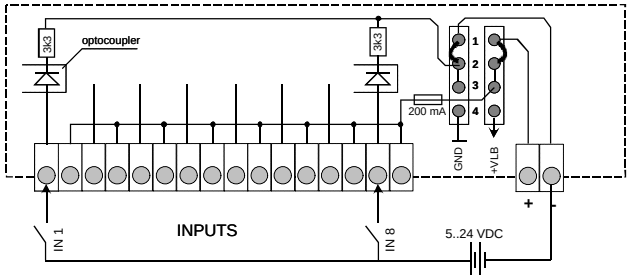
GALVANIC ISOLATION OF CHANNELS



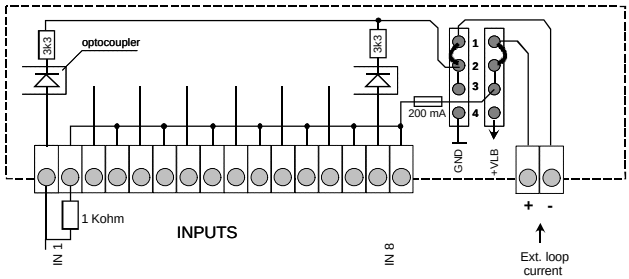
If you want galvanic isolation between the inputs and TC, adjust the jumpers to between 1 and 2. Now the power for the control circuits is supplied through the EXT.LOOP CURRENT connector.

CHANNELS IN CAR USE

If TC is used in a car, it is customary that the inputs are connected to potential coupling points. In this case, the minus of the car battery is connected to the minus connector of the EXT.LOOP CURRENT and the input information to the leftmost INPUT connection pair.

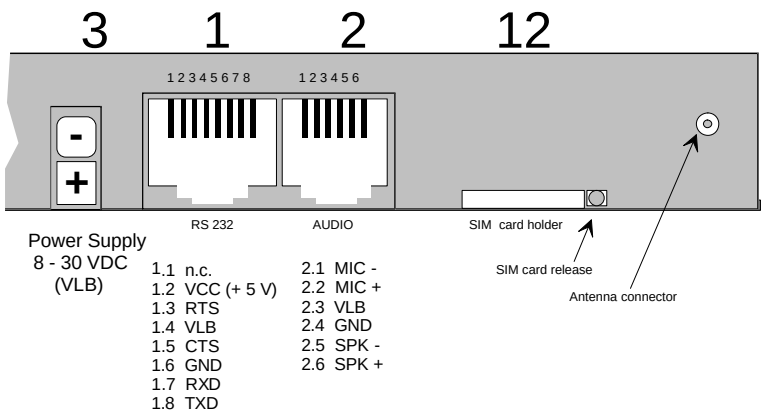


CONNECTING TC TO A DEVICE GIVING ONLY MINUS

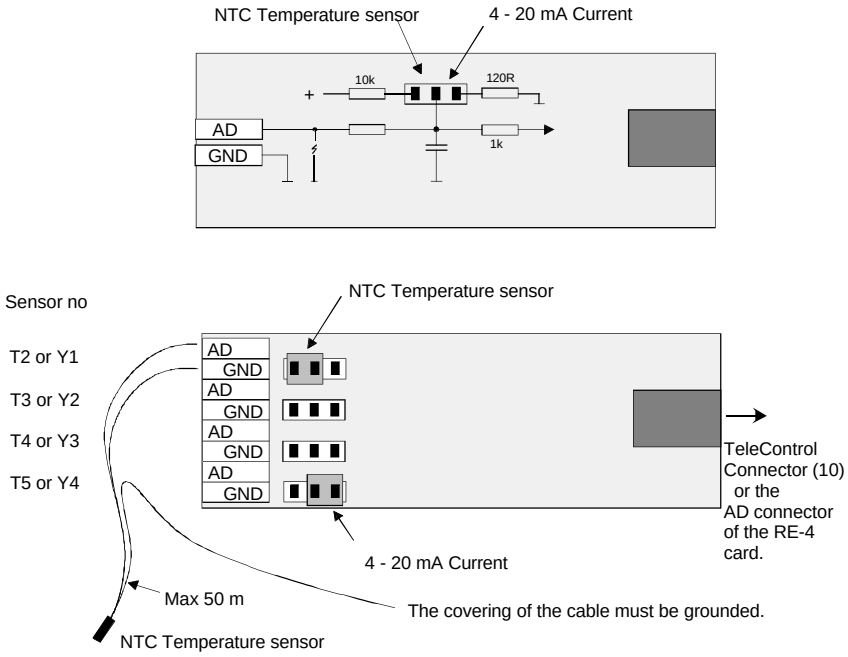


Attach 1 Kohm resistor to the input and the incoming signal to the leftmost connector in the connector pair. The polarity of the contact is changed to the opposite to the sending device.

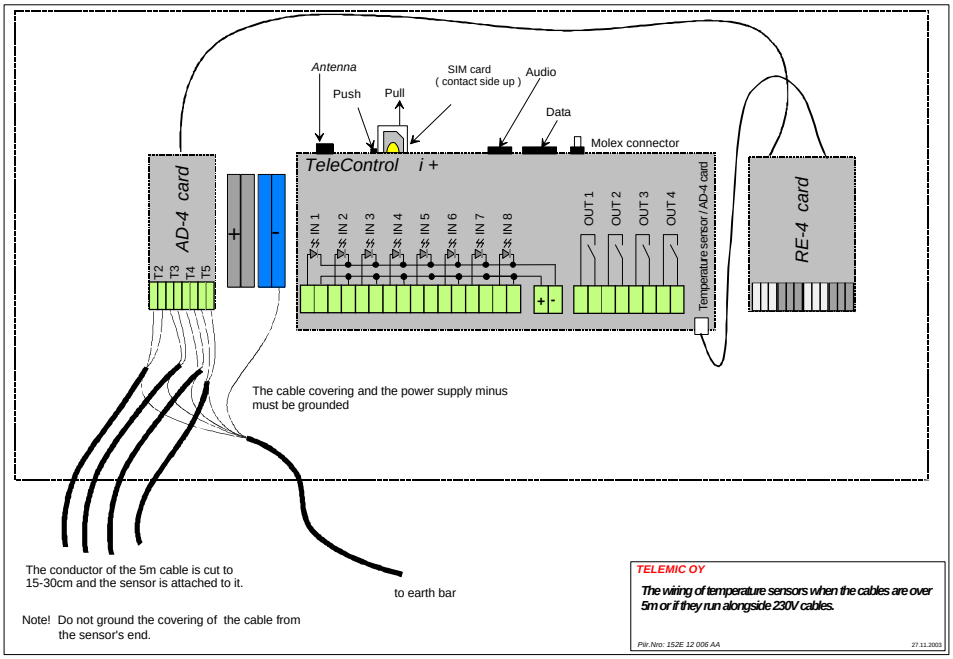
8.2 Power Supply, Serial, and Audio Connectors



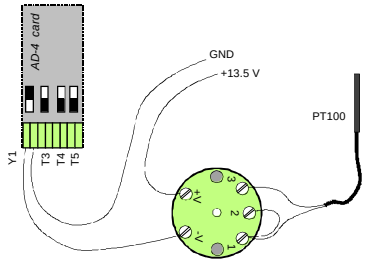
8.3 External AD-4 Conversion Card



8.4 Connecting Sensors and RE-4 Relay Card



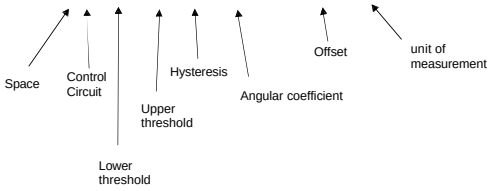
Connecting PT100 sensor



A PT100 sensor is connected to the channel 16
(1st inout on AD-4 card). PT100 measurement range is 0..150 c.

For example, give the following parameters to channel 16 with command #A25:

 # A 2 5__2__55__120__3__0.1908__-37.595__C



Set the parameters with command #I16:

 # I 16__2__1__10__10__Temperature Alarm $ Temperature OK

The above settings instruct TC to send an alarm message when lower or upper threshold is exceeded. Message is also sent when the temperature returns in the allowed range with 3 degree hysteresis.

TELEMIC OY
Connecting PT100 sensor
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9. INDEX

GUARANTEE

Telemic guarantees this TeleControl product for 12 months against material defects and flaws in manufacturing this product starting from the date of purchase. Defects are corrected with replacement parts, by fixing the old elements, or by providing a new equivalent product for the customer.

Defects that are caused by natural deterioration over time, overloading, or by any other inappropriate use of this product are outside the sphere of this guarantee.

Reclamations can be only accepted if the bought unit is returned to the retailer or to the manufacturer unopened.

PROOF OF COMPLIANCE TO STANDARDS

The manufacturer guarantees that this product complies with the following standards:

EN 55011, EN 50081-2, IEC 61000-4-3, Automotive EMC Directive 95/54/EY

TELEMIC OY

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