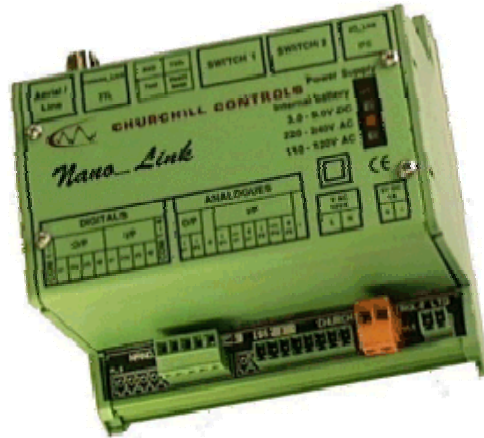


GSM_Link



Quick-Start Manual

	Date	Revision	Software Version
1	10/08/04		
1.1	17/09/04	Addition of separate diagrams for 3-wire analogue outputs	
1.2	21/09/04	Addition of 'Fitting a Sim Card' section.	
1.3	22/08/05	Add password protection and Interrogate mode	V1.08
1.4	06/02/07	Add MN command + DIPswitch settings + 15 min wake-up at 4:00pm	V1.15
1.5	19/02/07	Add Warning Sample Rate, Alarm Sample Rate & Battery Monitor	V1.16

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As part of our policy of continuous improvement we would welcome any suggestions for changes to the document.

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1 Introduction

GSM_Link is a telemetry module which operates as an outstation using the GSM telephone network to communicate with a mobile phone and/or a computer running **PC_Link** software.

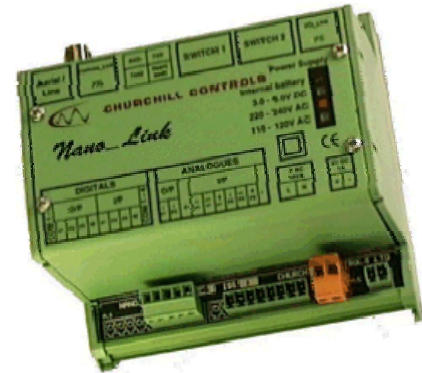
GSM_Link can be configured from a mobile phone or **PC_Link**. This allows the user to give plain English names to all monitored parameters and scale them in real units. The user can remotely interrogate **GSM_Link** at any time, and configure it to automatically report alarm conditions as they happen. **PC_Link** can also configure **GSM_Link** to log analogue and count values at regular intervals (and time-tagged digital events) and call it at a defined time to download the log.

GSM_Link will normally respond to the telephone number of the last phone to call it. This means that if, for example, a duty engineer changes shift, the new duty engineer can send **GSM_Link** a command to reset its number. Any subsequent alarm calls will be sent to the new duty engineer. Other commands can be sent to **GSM_Link** to interrogate it without changing the call-out number.

GSM_Link can be fitted with a variety of power supplies. If it is configured to run on an internal battery the user can typically expect a life in excess of 2 years before the batteries need replacing. It uses standard alkaline batteries that are readily available everywhere.

GSM_Link has the following capacity:

- 4 Digital Inputs (which can each be configured as alarm/status indications or pulse counters)
- 2 Analogue Inputs
- Mains (85...265VAC + battery back-up), battery (3 x alkaline D cells) or solar power supply
- Switched 12V output to power transducers
- 16 configuration DIP switches



2 Connecting GSM_Link

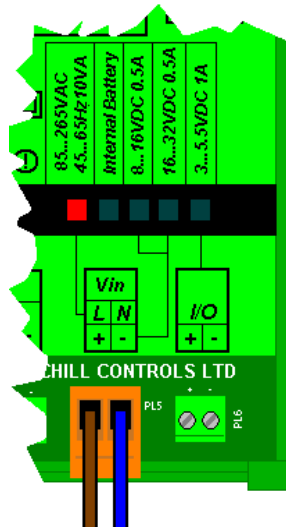
2.1 Power Supply

GSM_Link has six power supply options. These are denoted by a flag in the relevant window on the front of the unit as shown:

Mains:

The internal power pack accepts an input in the range 85...265VAC.

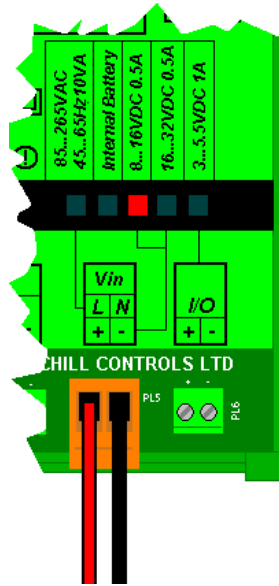
It includes rechargeable Ni-Cad batteries to support the unit in the event of a mains failure.



12V Supply:

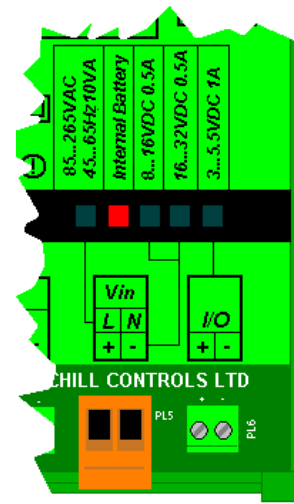
The unit will operate from a supply in the range 8...16VDC.

This is intended for operation from 12V nominally.



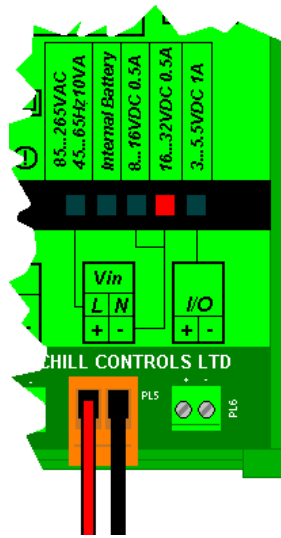
Internal Battery:

The internal battery pack holds three D alkaline cells. Care should be taken to configure the unit to with settings which optimise battery life.



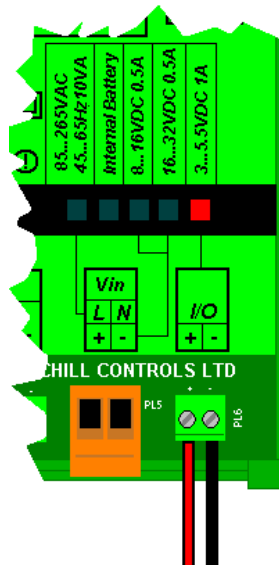
24V Supply:

The unit will operate from a supply in the range 16...32VDC.



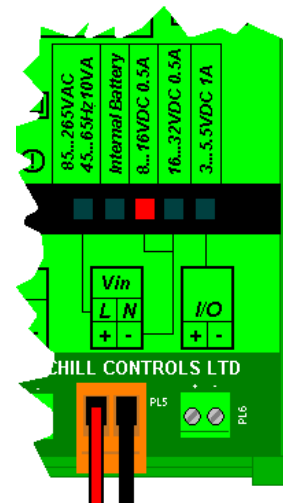
5V Supply:

The unit will operate from a supply in the range 3...5.5VDC.



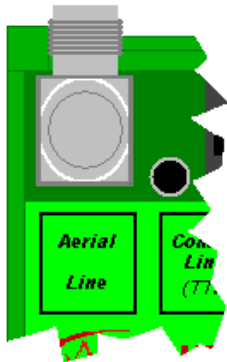
Solar Supply:

Solar power requires a solar panel, solar controller and lead-acid battery. Refer to the Installation Manual for details.



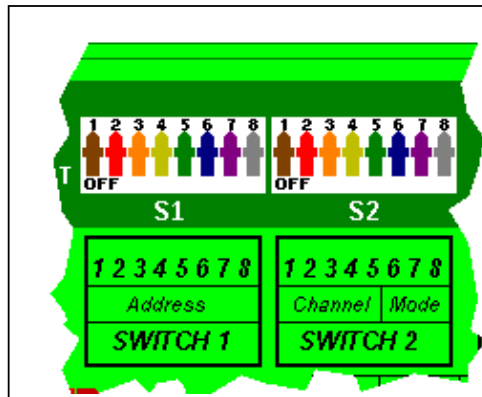
2.2 Antenna

Mobile antenna



GSM_Link is fitted with a TNC co-axial connector as shown. The antenna supplied can be connected directly to this connector, or can connect to it via a lightning protection unit, which is recommended when the aerial is mounted outside.

2.3 DIP Switch Configuration



If all poles of Switch 1 are in the UP position, *GSM_Link* will enter a sleep condition to minimise power consumption. In normal operation Switch 1 should be set to 10000000 (where 1 = UP, 0 = DOWN) and Switch 2 should be set to 00000001 if the unit is mains powered, or XY000000 if it runs from batteries.

XY set the time the unit stays awake checking for SMS messages: 00 – 1 min, 10 = 2 mins, 01 = 3 mins, 11 = 4 mins

2.4 Fitting a SIM Card

To operate on the GSM network, *GSM_Link* must have a SIM card fitted.

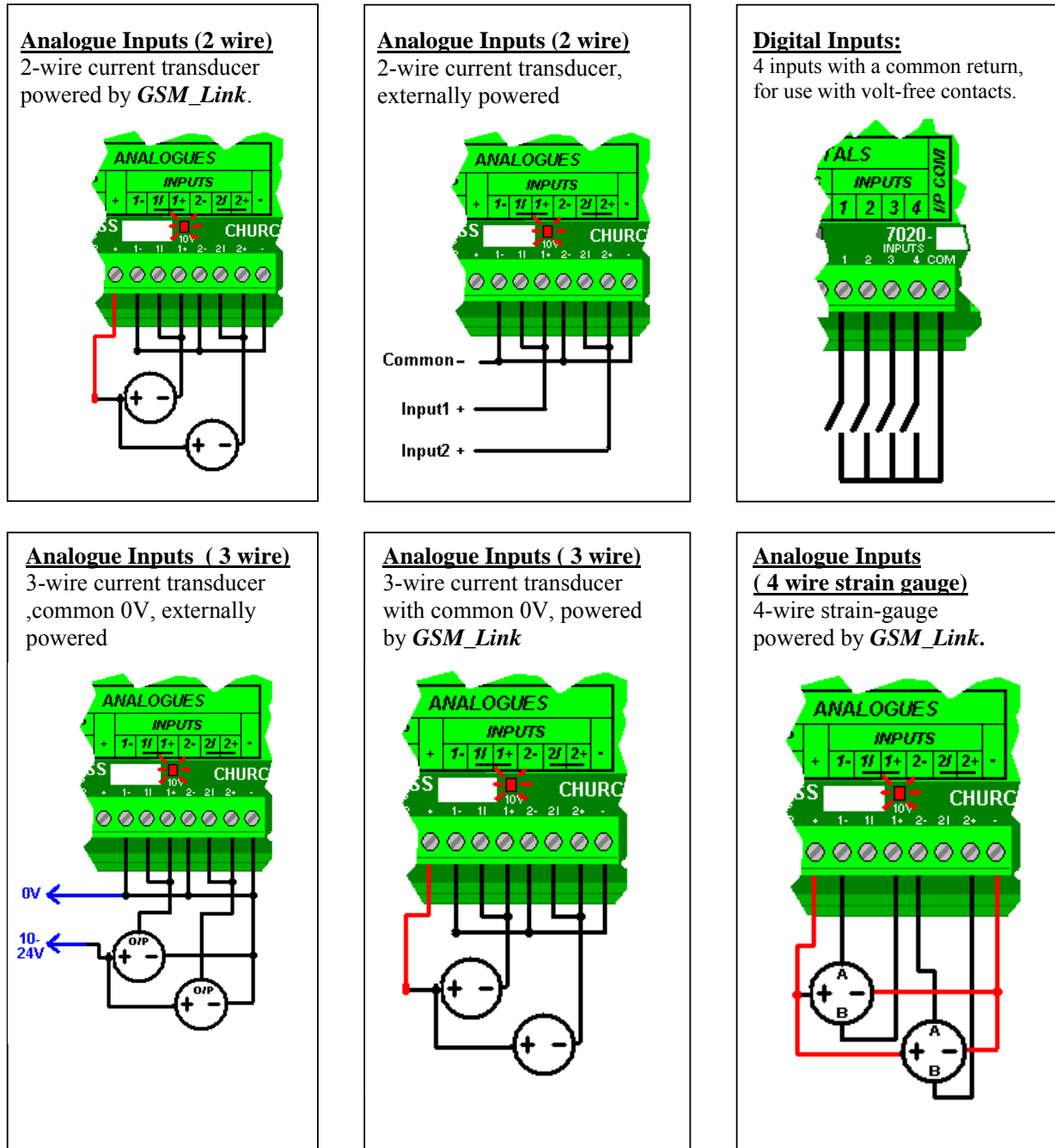
To access the SIM card holder, remove the top cover of *GSM_Link* and remove the Power Supply board. The SIM card holder will now be visible. The tray is removed by depressing the yellow button to the left of the holder. The user may now insert the required SIM card into the tray and slide it back into place.

When powering up the *GSM_Link*, if the alphanumeric display is fitted, choose the 'Diagnostics' option. Here the user can watch to ensure that *GSM_Link* can register on the network. *GSM_Link* should then begin checking for SMS messages. If a Vodafone or O2 SIM is fitted – and the tariff is a Pay-As-You-Talk type – the available credit will also be shown.

2.5 Inputs

GSM_Link can accept 4 digital inputs. The basic connection requirements for each are detailed below. Each input is assumed to be a volt-free contact (which can represent a status or alarm) or a pulse output from a meter. For more detailed information, refer to the Technical Manual.

GSM_Link also provides 2 analogue inputs, and a switched 12V supply output that can be used to power transducers. Connections from this are shown in **red**. Alternatively, transducers may be externally powered - these connections are shown in **blue**. The LED adjacent to the connector lights whenever 12V is available.



3 Using *GSM_Link* with a Mobile Phone

GSM_Link can be interrogated by either mobile phones or by a computer running appropriate software. Any mobile phone can call a *GSM_Link* using simple SMS text commands. The command messages are kept as short as possible for ease of use:

3.1 Message Structure

All commands begin with '**M**' (indicating a message from a mobile phone) or '**I**' (for interrogate). For added security the user can also configure a 4-character alphanumeric password number that must be prefixed to every command.

The next character is the op code, and this will be followed by either a question mark '?' (to specify a request) a delimiter character ':' (to request and/or download configuration data) or an equals sign '=' (to upload configuration data).

GSM_Link will respond to any valid message by sending a text message to the number from which the command was received. If the command begins '**M**' it will memorise the number, and return any future alarm messages to that caller. However, this can be over-ridden by downloading a list of numbers to which alarm messages must be sent. If a list is downloaded alarms will be sent just to the numbers in the list, regardless of the number from which the last command was received.

If the command begins with '**I**' *GSM_Link* will not modify the number in its memory, thus allowing a user to interrogate it without changing the destination to which alarms will be sent. For clarity all illustrations that follow assume the command begins with '**M**', but they could equally begin with '**I**'.

Full details of the available op codes are given later in this document, but typical commands to *GSM_Link* could be:

- MA?** Request the current status of analogue inputs and simultaneously update *GSM_Link* to send alarms to caller's phone (unless a list of telephone numbers has been sent via the **MN** command). (Assumes no password protection enabled).
- ID:** Request the configuration of digital inputs (without changing the number to which alarms will be sent). (Assumes no password protection enabled.)
- AbcdIC:** Request the configuration of count inputs (without changing the number to which alarms will be sent). (Assumes password protection has been set to 'Abcd' via the **MP** (3.1.1 below) command).

All messages from *GSM_Link* are prefixed by the outstation name, which will be followed by the amount of credit remaining on its SIM card, if applicable. Credit is only valid if *GSM_Link* is fitted with a Pay As You Go SIM, and then only if the chosen network allows *GSM_Link* to read the remaining credit.

When downloading a configuration to *GSM_Link*, parameters are separated by a comma ',' as a field separator. If the parameter content is '#' the outstation will delete any previous value. If the parameter content is blank (i.e. two consecutive commas ',,') *GSM_Link* will retain the previous value. A download command with no data following it will not change data at the outstation, but will still cause it to give the specified response back to the source.

All descriptors have a maximum length of 20 characters. Note, however, that since SMS messages are limited to 160 characters, repeated use of long descriptors could result in a message being truncated.

If *GSM_Link* was supplied with a SIM card you will have been provided with the relevant telephone number. If you have provided your own SIM card it will be necessary for you to establish the phone number of the outstation before proceeding. Note that, if you have a 7177 Alphanumeric Display Module it can be plugged into the *I/O_Link* port on *GSM_Link* and used to read the telephone numbers, if they are available from the chosen network.

Configuring *GSM_Link* is achieved by sending SMS messages as described below. It is recommended that the parameters are sent in the order shown. For example, analogues high and low alarm levels should not be set until after configuring the appropriate scaling.

3.1.1 Message type MP

This message configures password security at the outstation.

An example download command could be:

```
MP:pass
```

This will set the password number to the text string **pass**. All subsequent commands to the outstation will thus have to be prefixed with this string. *GSM_Link* will respond with an SMS message repeating the station name:

```
Linton Reservoir  
Credit:23.45  
Password set to:pass
```

Note that passwords are not case sensitive, so **pass**, **Pass** and **PASS** would all be accepted.

If a command is subsequently sent to *GSM_Link* with no password, or with an incorrect password, it will respond with the message:

```
Linton Reservoir  
Credit:23.45  
Wrong password
```

The user can change the password by sending a command such as:

```
passMP:1234
```

The password **xxxx** has a special meaning, in that it clears any previous password setting. Therefore the user can delete the password by sending a command such as:

```
1234MP:xxxx
```

GSM_Link will respond with an SMS message repeating the station name:

```
Linton Reservoir  
Credit:23.45  
Password set to:----
```

3.1.2 Message type MO

This message configures the name of an outstation.

The general download command format is:

```
MO:Outstation Name
```

An example download command could be:

```
MO:Linton Reservoir
```

GSM_Link will respond with an SMS message repeating the station name:

```
Linton Reservoir  
Credit:23.45
```

Note that Credit will only be shown if it is available from the network.

If the download command was:

```
MO:Linton North Reservoir
```

GSM_Link would truncate the name to 20 characters and respond:

```
Linton North Reservo  
Credit:23.45
```

The upload command is:

```
MO=
```

GSM_Link's response will be the same format as the general download command. This makes it easy for the user to modify the configuration and download it.

The request command is:

```
MO?
```

GSM_Link's response will be the same as that for the general download command.

3.1.3 Message type MD

This message configures the digital inputs of an outstation, or requests their current state.

The general download command format is:

```
MD:  
D1 name,D1 state1,D1 state0,  
D2 name,D2 state1,D2 state0,  
D3 name,D3 state1,D3 state0,  
D4 name,D4 state1,D4 state0
```

Where state1 is the state reported when the corresponding digital input contact is closed, and state0 is the state reported when it is open.

An example download command could be:

```
MD:Pump1,Running,Stopped,Inlet V  
alve,Open,Closed,Intruder,Alarm,No  
alarm,##,##
```

Note that in this example digital input 4 is not used (as will be seen in the MC command (3.1.5below), in this example digital 4 is being used as a count input).

GSM_Link will respond with a message confirming the configuration:

```
Linton Reservoir  
Credit:23.45  
Digitals  
1 Pump1:Running,Stopped  
2 Inlet Valve:Open,Closed  
3 Intruder:Alarm,No alarm  
4
```

The upload command is:

```
MD=
```

GSM_Link will respond with a message in the same format as the general download command. This makes it easy for the user to modify the configuration and download it.

The request message format is:

```
MD?
```

GSM_Link will respond with a message reporting the current state of the digital inputs, for example:

```
Linton Reservoir  
Credit:23.45  
Pump1:Running  
Inlet Valve:Open  
Intruder:No alarm  
Mains:5.10V OK  
Battery:5.10V OK
```

Since digital input 4 is unused, it is ignored from the report. The mains power status will only be shown if the *GSM_Link* is set to mains operation (i.e. Switch 2.8 closed). Note that if the battery voltage passes a threshold that indicates it is not charging, and exception reporting is enabled (see 3.1.6 below), a Mains Fail exception report will be sent. Similarly, if the battery voltage reaches a level which indicates it is approaching the end of its life a Battery Low exception report will be sent.

3.1.4 Message type MA

This message configures the analogue inputs of an outstation, or requests their current state.

The general download command format is:

```
MA:A1 name,A1 min,A1 max,A1 units, A2
name,A2 min,A2 max,A2 units
```

Where min is the value to be reported when the analogue input reads zero (i.e. 0.00mA or 0.00mV), and max is the value to be reported when the input reads 100%, and units are the units of measure. The values subsequently reported would be to whichever is the higher number of decimal places in the max and min value

An example download command could be:

```
MA:Res Level,0,5.50,m,Outlet
Flow,-250,1000,l/sec
```

Note that this is specifying that the value for Res Level is required to two decimal places, and is assumed to originate from a transducer calibrate 0...20mA (or 0...100mV). It is assumed that the Flow is derived from a 4...20mA transducer calibrated 0...1000 l/sec. A hypothetical value of 0mA would therefore correspond to a flow rate of -250 l/sec.

GSM_Link will respond with a message confirming the configuration:

```
Linton Reservoir
Credit:23.45
1 Res Level:0.00...5.50m
2 Outlet Flow:-250...1000l/sec
```

The upload command format is:

```
MA=
```

GSM_Link's response will be the same format as the general download command. This makes it easy for the user to modify the configuration and download it.

The request message format is:

```
MA?
```

GSM_Link will respond with a message reporting the current state of the analogue inputs, for example:

```
Linton Reservoir
Credit:23.45
Res Level:4.92m HiHi
Outlet Flow:592l/sec
Battery:4.50V
```

Note that *GSM_Link* will append LoLo, Lo, Hi or HiHi if the reading is in one of the alarm states defined by the ME command (3.1.6 below).

Note also that the battery voltage is appended.

3.1.5 Message type MC

This message configures the count inputs of an outstation, or requests their current state.

The general download command format is:

```
MC:C1 name,C1 Scale,C1 units,
C2 name,C2 Scale,C2 units,
C3 name,C3 Scale,C3 units,
C4 name,C4 Scale,C4 units
```

An example download command could be:

```
MC:#,0,#,#,0,#,#,0#,Totalised
Flow,10,litres
```

In this example digital inputs 1, 2 & 3 are not used for counts. Digital input 4 is configured to read “Totalised Flow” in litres – where each pulse is equivalent to 10 litres.

GSM_Link will respond with a message confirming the configuration:

```
Linton Reservoir
Credit:23.45
1
2
3
4 Totalised Flow:10 litres
```

The upload command format is:

```
MC=
```

GSM_Link's response will be the same format as the general download command. This makes it easy for the user to modify the configuration and download it.

The request message format is:

```
MC?
```

GSM_Link will respond with a message reporting the current totals of the count inputs, for example:

```
Linton Reservoir
Credit:23.45
Totalised Flow:19340 litres
```

3.1.6 Message type ME

This message defines the events that constitute exception alarms, and the action to be taken when they occur. When an alarm is detected it can be:

- a) Reported to a base-station via a data call. Data calls are ‘live’, so cannot be delayed by the network.
- b) Reported to one or more mobile phones via SMS text messaging. The delivery time of SMS messages is not guaranteed, so although they are normally delivered within a short period of time, if the network is congested they can take longer. The mobile phones to which exception reports are sent are defined using the **MN** command (0 below).
- c) Logged in memory as time-tagged events that can be subsequently downloaded to a base-station.

The general download command format is:

```
ME:LBM,abcd,efgh,
A1 LoLo,A1 Lo,A1 Hi,A1 HiHi,
A2 LoLo,A2 Lo,A2 Hi,A2 HiHi,
A1 Hyst,A2 Hyst
```

The first parameter is a 3-digit number, where each digit is 1 or 0. Characters L and B relate only to a *PC_Link* base-station, so when configuring *GSM_Link* from a mobile phone these should be replaced with 0 to disable base-station reporting or the character ‘#’ to leave them unchanged. If M = 1 the outstation will report all exceptions to one or more mobile phone(s) via SMS messages. See the **MN** command (0 below) for an explanation of the phones to which exception reports will be sent.

The second and third parameters define exception reporting for digital inputs, where each digit is 1 or 0. If ‘a’ is 1, digital input 1 will generate an exception alarm if its contacts close. Digits ‘b’, ‘c’ and ‘d’ perform the same function for inputs 2, 3 and 4. If ‘e’ is 1, digital input 1 will generate an exception alarm if its contacts open. Digits ‘f’, ‘g’ and ‘h’ perform the same function for inputs 2, 3 and 4. *Note that if exception reporting is enabled using the L, B and/or M bits defined above, a message will be sent whenever the battery and/or mains power supply passes an alarm threshold (i.e. if the battery goes from normal to low or the mains power fails or is restored).*

The remaining parameters define analogue warning and alarm limits in the units defined by the ‘**MA:**’ command (3.1.4 above). Hi and Lo limits can be regarded as warning limits, whereas HiHi and LoLo limits are treated as alarm limits.

Note that if the analogue configuration is subsequently changed the warning and alarm limits may have to be re-defined.

An example download command could be:

```
ME:001,1100,1010,0.25,0.5,4.8,5.2,#,  
150,900,#,0.05,50
```

In this example all exceptions will be reported to the mobile phone. Digital input 1 will exception report on all changes. Digital input 2 will exception report if it closes, but not if it opens. Digital input 3 will exception report if it opens, but not if it closes, and digital input 4 will not report any changes.

Analogue 1 will generate a LoLo exception alarm if the level drops below 0.25m, and clear the alarm when the level rises to 0.30m (A1LoLo + A1Hyst). The remaining analogue limits can be similarly deduced. Note that '#' character disables the alarm.

GSM_Link will respond with a message confirming the configuration:

```
Linton Reservoir  
Credit:23.45  
Exceptions: L-M  
Dig: 1100,1010  
1 Res Level:0.25,0.50,4.80,5.20,0.05,m  
2 Outlet Flow:#,150,900,#,50,l/sec
```

The '#' symbol indicates that the relevant alarm level is disabled

The upload command:

```
ME=
```

And the request command:

```
ME?
```

Will both cause *GSM_Link* to send a message in the same format as the general download command. This makes it easy for the user to modify the configuration and download it.

In this example, if digital 3 closes, *GSM_Link* will send the following text message to the mobile phone:

```
Linton Reservoir  
Credit:23.45  
Intruder:Alarm
```

Similarly, if analogue 1 drops below 0.25m it will send the following text message:

```
Linton Reservoir  
Credit:23.45  
Res Level:0.24m LoLo
```

In the event of a mains power failure, *GSM_Link* will send the following text message to the mobile phone:

```
Linton Reservoir  
Credit:23.45  
Mains:Fail
```

Similarly, if the battery falls below a lower voltage threshold, *GSM_Link* will send the following text message to the mobile phone:

```
Linton Reservoir  
Credit:23.45  
Battery:Low
```

3.1.7 Message type MN

This message configures the telephone numbers of the mobiles to which exception reports will be sent (see **ME** command, 3.1.6 above). If no numbers are configured, *GSM_Link* will by default send exception reports to the last mobile phone that called it.

The general download command format is:

MN:07786461584,07831794692,07879237762, 07786448241, 07831786245

Where 07786461584, 07831794692, 07879237762, 07786448241 and 07831786245 are the telephone numbers of the mobile phones.

As with all other commands, # will delete any previous number and a blank entry (i.e. two consecutive commas ,,) will leave the existing number unchanged.

GSM_Link will respond with a message confirming the configuration:

Linton Reservoir
O/S No:07879237762
B/S No:+4479017022631
Mob No:+447976220114
1:07786461584
2:07831794692
3:07879237762
4:07786448241
5:07831786245

O/S No is the telephone number of the SIM in the **GSM_Link**. Note that a number will be displayed only if the unit can request it from the network. Currently Vodafone are the only network providers who offer the facility to derive the number from the network. If the SIM operates on any other network the number will be blank.

B/S No is the number of the last base-station to call the **GSM_Link**. If it has not been called from a base-station the number will be blank

Mob No is the number of the last mobile phone to call the **GSM_Link**.

The numbers that follow are those that have been programmed for receiving exception reports. If no numbers have been programmed, exception reports will be sent to the Mobile No (i.e. the last mobile to have sent a command beginning 'M').

The upload command:

MN=

Will cause **GSM_Link** to send a message in the same format as the download command, which can then be edited if required and re-sent.

The request command:

MN?

Will cause **GSM_Link** to send a message in the same format as the response to the general download command.

3.1.8 Message type MI

This message configures digital initiation delays and analogue sample rates at the outstation.

The general download command format is:

**MI:ID1,ID2,ID3,ID4,ASR,WT,SSR,WA
SR,AASR**

The first four parameters define the initiation delay (in seconds) for digital inputs 1...4. Any change of state that exists for less than the initiation delay will be ignored. Initiation delays can be set in the range 0...510, and will be rounded down to even numbers of seconds.

Parameter ASR is the analogue sample rate, which defines the interval (in seconds) at which analogues will be read if neither is in any alarm or warning state.

Parameter WT defines the warm-up time of the transducers. If the outstation is battery-powered the transducers will be powered for this period before being read, and switched off after taking the reading. If the outstation is mains-powered the transducers will be permanently powered, so this figure will be ignored.

Parameter SSR is the SMS message scan rate, in minutes. It defines the interval at which a battery-powered outstation will wake up and listen for SMS messages. It stays awake for a period of 1, 2, 3 or 4 minutes, as defined by Switch 2 Poles 1 & 2. Regardless of this setting, a battery-powered outstation will always wake up at 4:00pm and stay awake until 4:15pm to allow instant access if required. Obviously, for this to take effect it is a pre-requisite that the clock has been set, either via an alpha-numeric display (see 5 below) or from a computer base-station. If SSR is set to zero the outstation will stay awake and check for SMS messages every 10 seconds.

Parameter WASR is the warning analogue sample rate, which defines the interval (in seconds) at which analogues will be read if either of them exceeds a warning limit (i.e. Hi or Lo limit).

Parameter AASR is the alarm analogue sample rate, which defines the interval (in seconds) at which analogues will be read if either of them exceeds an alarm limit (i.e. HiHi or LoLo limit).

An example download command could be:

```
MI:0,0,6,0,900,4,60,600,300
```

In this example, digital inputs 1, 2 & 4 will recognise a change of state immediately it occurs. Digital input 3 will only recognise a change of state when the new condition has remained constant for 6 seconds. The outstation will sample and log analogues every 900 seconds (i.e. 15 minutes) if they are within the alarm/warning limits. It will apply power to the analogue transducers 5 seconds before reading them. Furthermore, it will check for SMS messages every 60 minutes. If either analogue input exceeds a warning limit (i.e. Hi or Lo limit) the analogue sample rate will increase from 900 seconds to 600 seconds (i.e. 10 minutes). However, if either analogue input exceeds an alarm limit (i.e. HiHi or LoLo) the analogue sample rate will increase to every 300 seconds (i.e. 5 minutes).

GSM_Link will respond with a message confirming the configuration:

```
Linton Reservoir  
Credit:23.45  
ID: 0secs,0secs,6secs,0secs  
ASR: 15mins  
WASR: 10mins  
AASR: 5mins  
WT: 4secs  
SSR: 60mins
```

The upload command:

```
MI=
```

And the request command:

```
MI?
```

Will both cause **GSM_Link** to send a message in the same format as the response to the general download command. This makes it easy for the user to modify the configuration and download it.

4 Using *GSM_Link* with a Computer

As stated above, *GSM_Link* can be configured and interrogated by either a mobile phone or a computer.

If a computer is used, it must run *PC_Link* software. There are two parts to this, *PC_Link Config* and *PC_Link Display*. Both communicate with *GSM_Link* by using data calls, compared with the store-and-forward operation of SMS messaging. The delivery time of SMS messages is not guaranteed, and depends on the loading of the GSM network. Under worst case conditions SMS messages may not be delivered for several hours, which can cause problems if reporting alarm conditions. Data calls, by contrast, are similar to voice calls in that they establish immediate communication, with no delays.

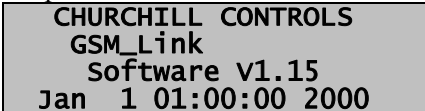
PC_Link Config allows the user to set all the configurable parameters described above via dialog boxes, then save them and/or download them to *GSM_Link*. It also incorporates additional commands allowing the user to configure logging within *GSM_Link*, and define times at which *GSM_Link* is to call the computer to download log data.

PC_Link Display receives calls from *GSM_Link* and collects log data from it. It stores this data in files that can be read by third-party software packages such as SCADA systems.

More details on *PC_Link Config* and *PC_Link Display* are given in the *PC_Link* Quick Start Manual.

5 Alphanumeric Display

The 7177 Alphanumeric Display is a useful diagnostic tool that can be used with *GSM_Link*. When the display is first plugged in it displays the splash screen:



```
CHURCHILL CONTROLS
GSM_Link
Software v1.15
Jan 1 01:00:00 2000
```

The user can select different display modes using the ▲ and ▼ buttons. In some modes the display will automatically scroll through various formats. In these modes the scroll can be frozen and unfrozen by pressing the ► button. In other modes the user can change values using the ► button. The first time the ► button is pressed in this mode the first adjustable parameter will be highlighted (e.g. **J**an). The ▲ and ▼ buttons can be used to adjust the value. Subsequent presses of the ► button allow successive parameters to be set. For example, the user can set the time and date in the splash screen. Note, however, that the time and date are only used by a *PC_Link* base-station (which will set the time itself) so manual adjustment of the clock is not generally needed.

The **DISPLAY CONFIG** mode (which can also be accessed by simultaneously holding down ▼ and ►) allows the user to configure the display itself:

- If the display mode is set to Always On, it will keep *GSM_Link* awake all the time, even if it is set for battery operation (by setting DIPswitch 2.8 down). However, if the display is set to Low Power it will allow *GSM_Link* to go to sleep. Pressing any button on the display will wake up *GSM_Link*, and it will stay awake until 30 seconds have lapsed since the last button press.
- The backlight can be switched off if required to conserve battery life.
- Analogues can be displayed in a variety of formats. If a format is selected that does not have a zero offset, any display mode that shows an analogue value will have the symbol **I** appended. If the format includes a zero offset (e.g. 4-20mA) the lower bar of the symbol will be raised.