AUTOMATION

User Manual

UM EN NLC-COM-GSM

Installation and configuration of the GSM Module on a nanoLC controller

PHOENIX CONTACT
INSPIRING INNOVATIONS

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User Manual

Installation and configuration of the GSM Module on a nanoLC controller

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Designation: UM EN NLC-COM-GSM

Revision: A

Order No.: –

This user manual is valid for:

Designation	Version	Order No.
NLC-COM-GSM		2701344

Please observe the following notes

In order to ensure the safe use of the product described, you have to read and understand this manual. The following notes provide information on how to use this manual.

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The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

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This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER
This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The following types of messages provide information about possible property damage and general information concerning proper operation and ease-of-use.

NOTE
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Should you have any suggestions or recommendations for improvement of the contents and layout of our manuals, please send your comments to

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1 Overview

The NLC-COM-GSM communication expansion module allows a nanoLC controller to communicate using the Global System for Mobile Communication (GSM) network. This wireless network is the same network that supports cellular telephones, providing communication access from virtually anywhere.

Not all areas have the GSM infrastructure in place. Phoenix Contact is not responsible and cannot be held liable for providing/supporting the network infrastructure. Access to this network must be authorized by a service provider that supports the GSM network in the area where the nanoLC will be installed and where the message(s) will be received.

The NLC-COM-GSM module is part of the nanoLC controller family, attaching to the left side of a base unit as a Communication Expansion module.

Only one Communication Expansion module may be connected to a base unit at a time.

A set of LEDs on the face of the NLC-COM-GSM module provide an overview of operational status. In addition, the software provides fault and warning strings that can be forwarded to remote locations. For additional information regarding the nanoLC product line, refer to the *nanoLC User Manual*.

1.1 SMS Messaging

The module supports the Short Message Service (SMS) protocol utilized by many cellular telephones and some other wireless devices. SMS allows text-based messages up to 160 characters (nanoNavigator messages are limited to 80 characters). Using SMS, the nanoLC can accept and send messages.

1.2 Configuration

nanoNavigator programming software is used to configure the module. Up to eight 18-digit telephone numbers can be entered in non-volatile memory. These numbers are then transferred to the SIM card installed in the NLC-COM-GSM module.

The eight telephone numbers can be configured to permit control messages to be received by the nanoLC, or to allow monitoring of control messages, faults and warnings via SMS messages.

For additional information regarding nanoNavigator software, refer to the *nanoNavigator Software Manual*.

1.2.1 Security

Several levels of password security prevent unauthorized changes to the nanoLC or unauthorized SMS commands from being executed by the nanoLC. This security is configured using nanoNavigator software. All passwords are optional.

– SIM Card Password: 4-character password that is stored on the SIM card. This must match the entry in the nanoLC or the modem is unusable.
– nanoLC Password: General password that prevents modification of the nanoLC configuration.
– each SMS message may include a 16-character password to limit unauthorized control and access to the nanoLC. Any incoming messages without the password are ignored.

2 Installation and Connection

As modular devices, the nanoLC system components are simple to connect and configure for specific applications. In addition to selecting the correct base unit, additional I/O modules with the desired I/O mix, communication modules and Operator Panel can be selected for the specific application.

2.1 Installing Modules on the Mounting Rail

This procedure describes only the installation of a base unit and Communication Expansion module connected to the left side of the base unit. For additional modules, refer to the *nanoLC User Manual*.

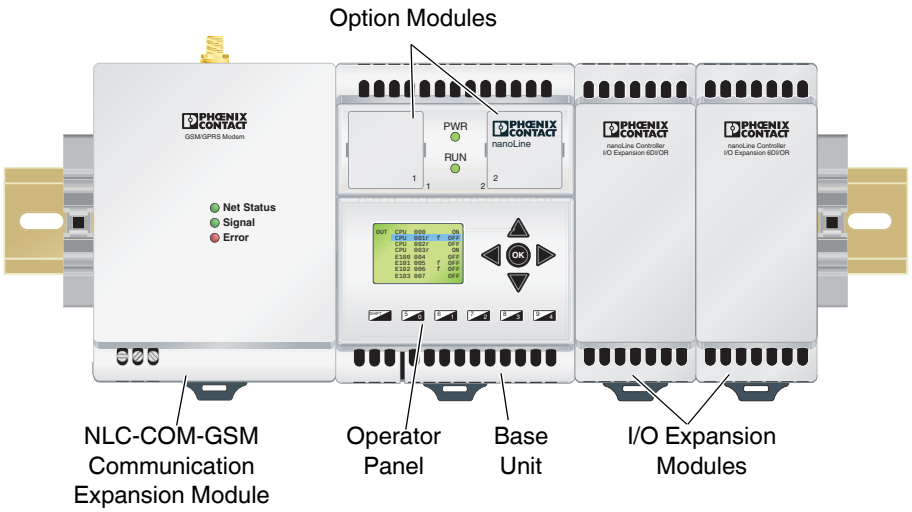

Figure 2-1 Module locations

1. Use a small screwdriver to remove the plastic over the DB-9 connector on the left side of the base module before mounting the module on the rail.
2. Pull the release latch out before positioning the base unit on the mounting rail.

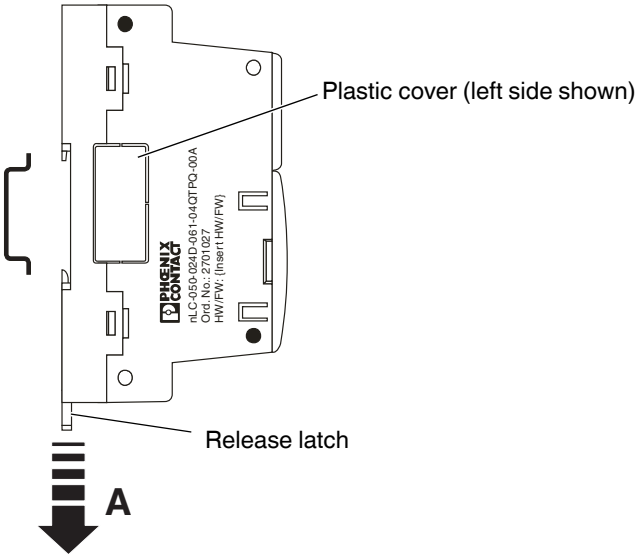

Figure 2-2 Base unit release latch

3. Hook the unit onto the mounting rail.
4. Swivel the module fully onto the rail and push the release latch in to secure it to the rail.

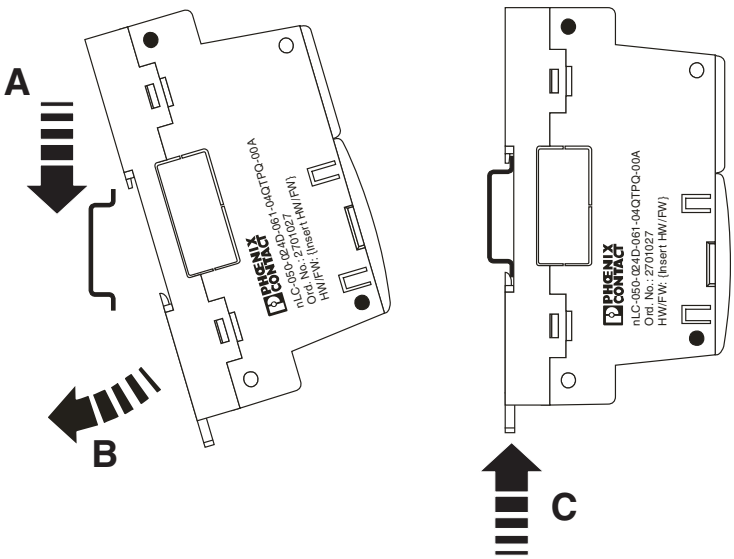

Figure 2-3 Rail placement

5. Repeat steps 2-4 for the NLC-COM-GSM module, placing it on the left side of the base unit.

6. Slide the module to the right against the base unit. A slight resistance will be felt as the DB-9 connectors mate. When properly installed the housing of the base unit and the NLC-COM-GSM module should touch.
7. Install clamps on each side of the nanoLC components to lock them to the rail. Order No. 0800886 is recommended.

2.2 Removing Modules from the Mounting Rail

To remove a nanoLC module from the mounting rail:

CAUTION:
Always disconnect power to the system at the power source before removing any components from the mounting rail. Do not remove power wires from the connector without disconnecting power at the source.

1. Disconnect power to the base unit at the power source. If input/output wiring is to be disconnected, disable any separate power supplies attached to effected I/O devices.
2. Disconnect the power supply wires from the base unit and communication module.
3. Slide the communication module to the left to separate it from the base module.

NOTE:
Do not slide multiple I/O expansion modules as a group as damage to the interfacing connectors may occur.

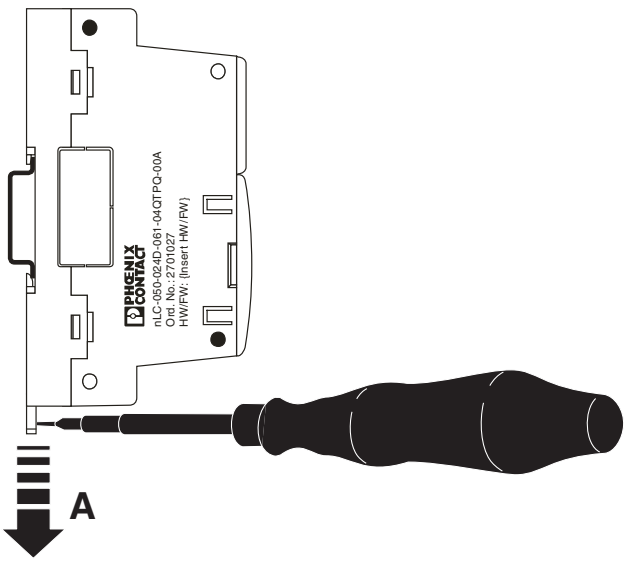

Figure 2-4 Latch release for module removal

4. With all wires to the module disconnected, use a small screwdriver to pull down on the release latch and lift the module off the mounting rail.

2.3 Power Connection

The nanoLC system components use a screw connection technology for power connection. Individual connection points are labeled on the housing surface with appropriate identifiers. Use a small screwdriver to turn the screw counterclockwise to release and clockwise to tighten wires after insertion into the appropriate position.

The NLC-COM-GSM module requires a power supply connection of 12 to 24 V DC (this can be shared with the base unit power connection). The connection terminals accept 0.14-2.5 mm^2 (14-26 AWG) wire. A functional earth ground is provided to direct any transients away from attached modules and components.

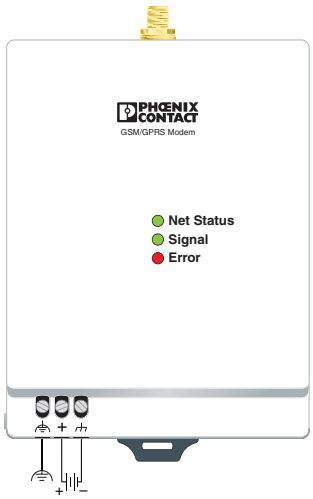

Figure 2-5 Power connections

2.4 Antenna Connection

To access the GSM network, an antenna (not included) must be connected to the NLC-COM-GSM module. The module connector is an SMA-F (female) requiring an SMA-M antenna connector.

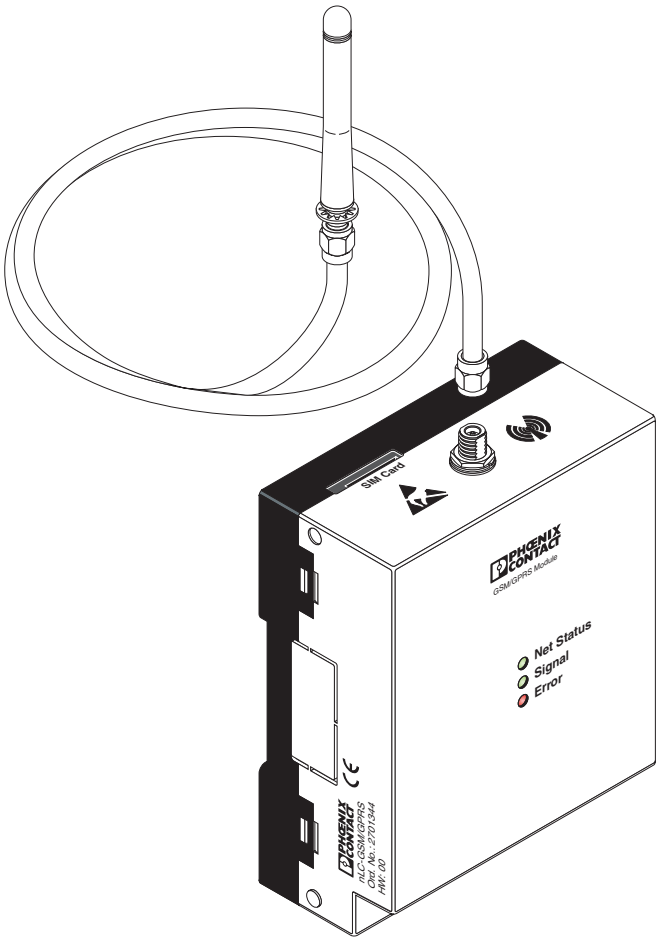

Figure 2-6 Antenna connection

Choose an antenna that meets the requirements for the application and the specifications of the NLC-COM-GSM module (see “Ordering Data” on page A-1 for a few options). If the direction of broadcast is known, a directional (YAGI) antenna can be installed. This will provide a concentrated signal in the direction it is pointed. An OMNI antenna broadcasts signals in all directions but it is a weaker signal since it is not focused in a specific direction. In lieu of doing a full site analysis, an antenna location can be tested using a cell phone, which uses the same network/antennas. A good cell phone signal will likely result in a good modem signal.

The antenna attaches to the end of the module. The antenna should be mounted in a clear area where limited interference will occur.

2.5 SIM Card Installation

Each NLC-COM-GSM module requires a SIM card.

The SIM card must be obtained locally and be compatible with a local service provider's towers. Additionally, the plan purchased from the service provider must include SMS messaging (texting). Not all service providers utilize a GSM network for texting.

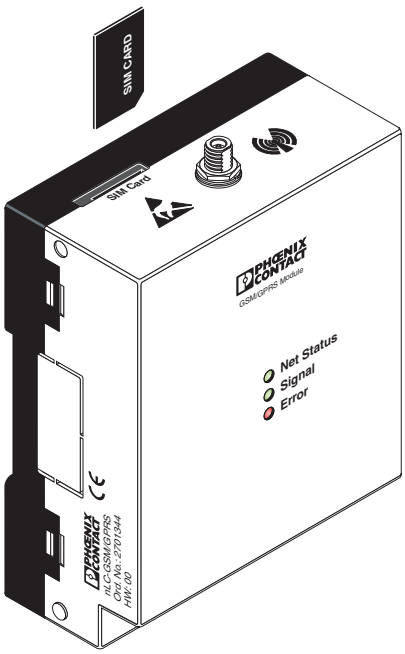

Figure 2-7 SIM card location

Orient the SIM card so the beveled corner is toward the middle and is inserted first. Push the card in until it clicks and stays seated. The slot is spring-loaded and will push the card out if not fully inserted in the slot. A small portion of the SIM card will stick out of the module when properly seated.

To remove a card, push the card into the slot and then release. The spring mechanism will eject the card from the slot.

NOTE:
If the SIM card has a PIN, do not insert the SIM card until after the PIN is entered in the nanoLC configuration (see "Passwords" on page 3-1).

2.6 LED Indicators

The LED indicators on the module indicate the following:

Table 2-1 Base Unit LED Indication

LED	Color	LED Status	Indication
NET STATUS	green	Off	Modem is off or no power present
		1-second flash	Connected to GSM network
		1/3-second flash	Searching for GSM network
SIGNAL	green	Off	No signal
		Flash(es)-pause	Flash rate corresponds to the number of bars on a cell phone[1] – On = 5 bars – 4 flashes = 4 bars – 3 flashes = 3 bars – 2 flashes = 2 bars – 1 flash = 1 bar – Off = no service
ERROR	red	Off	No alarms
		Flash	Incorrect PIN number[2]
		On	Indicates no SIM card installed or bad configuration file.

1 The signal strength flash rate corresponds to the Low RSSI signal warning message selection (see “System Messages” on page 3-6).

2 This is the SIM card PIN number. Requires a reset by the service provider if an incorrect PIN is entered three times in a row.

3 Configuration

Configuration of the NLC-COM-GSM module (and other nanoLC modules) requires nanoNavigator software (www.nanoNavigator.com).

3.1 Passwords

Several different passwords provide security and protection against unauthorized use of the NLC-COM-GSM module.

– SIM Card PIN: Most SIM cards come with a password. This password must be entered in the NLC-COM-GSM module to allow the module to communicate through the SIM card. The SIM card PIN must be entered at initial bootup or access to the SIM card is denied. Typically, if an incorrect PIN number is entered three times in a row, the SIM card is locked and must be reset by the service provider.
– SMS password: When calling the NLC-COM-GSM module, this optional password prevents unauthorized access. Passwords can be up to 16 characters and must use SMS-valid characters (see “Message format from NLC-COM-GSM” on page 4-3). Telephone numbers are blocked even if they are entered in the Telephone Book, if the message does not include the password.

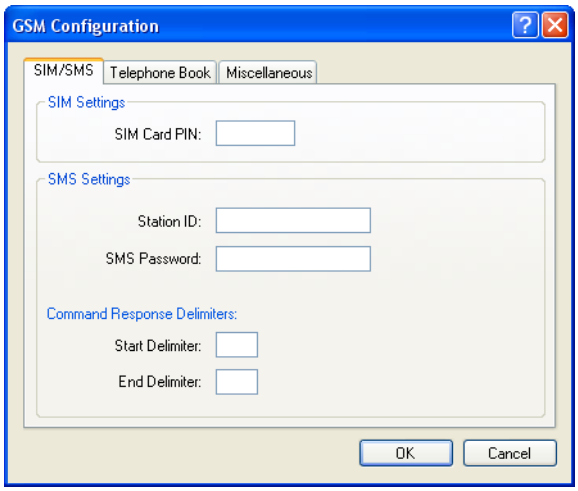

Figure 3-1 “GSM Configuration… Network/Sys” dialog box

If multiple nanoLC controllers are configured to send to the same telephone number, a **Station ID** provides a method to identify the sending controller. The Station ID is included with the message sent from the controller (see “Message format from NLC-COM-GSM” on page 4-3).

The “Station ID” field is case-sensitive. The field can accept up to 16 characters and must be SMS-valid characters.

SIM Card PIN Bootup Procedure

If the SIM card utilizes a PIN for security (varies by service provider), the correct PIN number must be entered in the project configuration before it is downloaded to the nanoLC and transferred to the NLC-COM-GSM module.

At power up the NLC-COM-GSM attempts to unlock the SIM with the PIN. If the nanoLC is booted with a SIM card installed and an incorrect PIN number in the configuration, it will result in a failed sign-on attempt, exhausting one of the three sign-on attempts.

Typically if the incorrect PIN is tried three times, the SIM is locked and you must contact the service provider. If power is applied before there is a configuration, the NLC-COM-GSM module attempts to unlock the SIM with no PIN and that is one of the three attempts.

3.1.1 Command Response Delimiters

When communicating directly to a device other than a telephone or another nanoLC, it may be useful to signify the beginning and end of an SMS message through the use of delimiters. Delimiters are placed at the beginning and end of messages generated by the NLC-COM-GSM module.

The 2-character delimiter should be a character sequence that will not be generated by the nanoLC. Project messages do not include the delimiters. If message delimiters are required within a project message, they may be entered in the message using the Message Editor.

Example

For example, for the following message sent to the nanoLC:

```
W F 1=1
```

The response from the nanoLC will be

```
/*W F 1=1: Command Executed*/
```

where **/ *** is entered in the “Start Delimiter” field and ***/** is entered in the “End Delimiter” field (see “SMS Messages” on page 4-1 for more information on message formats). This example uses start and stop delimiter character sequences that are not part of any standard fault, warning or reply message.

3.2 Messages

A total of eight telephone numbers can be entered in the telephone book. Each number can be individually configured to send project messages, system messages (faults and warnings), accept control messages (SMS Commands) or receive copies of all incoming SMS Commands (CC Cmd).

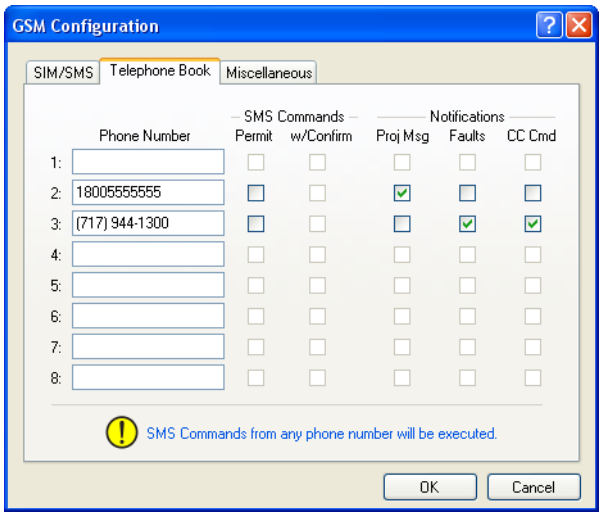

Figure 3-2 “GSM Configuration… Telephone Book” dialog box without SMS Commands

Use the “GSM Configuration… Telephone Book” dialog box to enter the telephone numbers and select the type of message(s) that can be received/transmitted. Each row allows entry of a telephone number and the corresponding message types to send or receive from that phone number. Messages are grouped as SMS Commands or Notifications. The check boxes are gray and cannot be clicked until a number is entered in the “Phone Number” field.

The “Phone Number” field accepts numeric characters and characters that might typically be used to express a telephone number, such as #, -. (and).

The default setting for the telephone book is to allow all telephone numbers full access to the controller. This is indicated by a message at the bottom of the dialog box.

NOTE:

If no telephone numbers are entered in the telephone book, the NLC-COM-GSM module is “open” to anyone who knows the telephone number. Restriction of incoming calls only occurs if a number is entered in the “Phone Number” field and the corresponding “Permit” check box is clicked.

The message will change as soon as a “Permit” check box is clicked (see Figure 3-3).

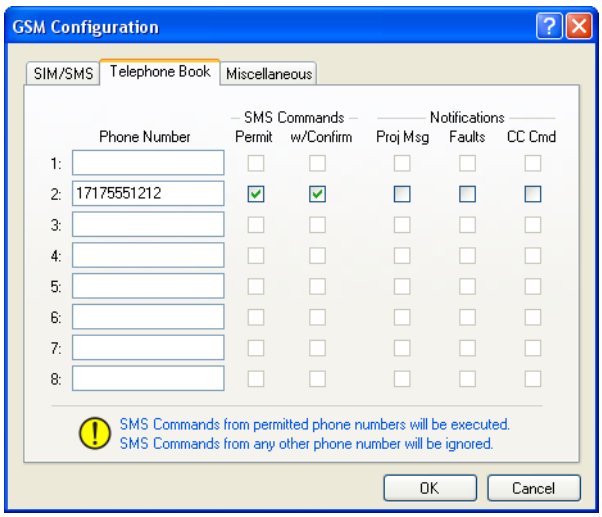

Figure 3-3 “GSM Configuration… Telephone Book” dialog box with SMS check box

The message types are:

– Permit: Allows the listed telephone number to send read and write requests in an SMS format to the NLC-COM-GSM module.
– w/Confirm: Sends a confirmation message of a write command back to the listed telephone number.
– Proj. Msg: Sends messages created in the project using the Message Editor to the listed telephone number.
– Faults: Sends fault and recovery notification messages to the listed telephone number.
– CC Cmd: Sends a copy of all read and write messages to the listed telephone number. This is typically not checked for the same telephone number that is permitted to perform read and write commands, but is used by a person or machine to monitor commands coming from other sources. Text messages to this number also include the command that was sent as well as the telephone number of the sender.

3.2.1 Project Messages

User-defined project messages are created within each project using the Message Editor. Click the “SMS Messages” check box to send the messages to the telephone numbers which have the “Proj. Msg” box checked (see Figure 3-2).

The “SMS Messages” check box is only visible if a communication expansion module that supports this function is selected in the nanoLC configuration. If necessary, check the nanoLC Configuration to ensure the correct module is selected.

To display the message on an Operator Panel, click the “nanoLC Display” check box. Project Messages can be displayed in both locations.

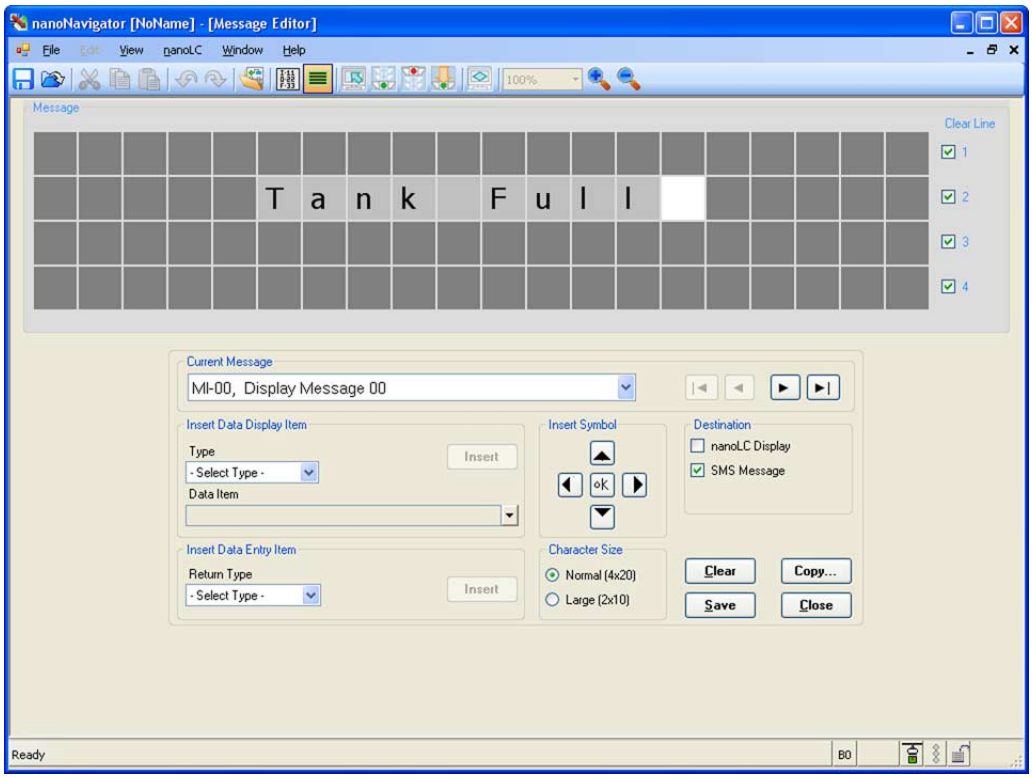

Figure 3-4 Message Editor

Project messages always send all 80 available characters in an SMS message, even if the “block” is blank in the Message Editor.

3.2.2 System Messages

Several NLC-COM-GSM module (Table 3-1) and base unit (Table 3-2) conditions are monitored, and warning and recovery messages are provided to the specified telephone numbers. To send the Warning and Recovery Messages to a telephone number, click the “Faults” check box next to “Phone” field (see Figure 3-3).

Table 3-1 NLC-COM-GSM Module Conditions

Condition	Warning Message	Recovery Message
No nanoLC Communications	No Communications with nanoLC. SMS messages will not be processed.	Communications with nanoLC restored
Low RSSI signal strength	Low GSM Signal Strength. SMS messages may not be processed	GSM Signal Strength OK
SMS Watchdog Timer	SMS Command Watchdog Timeout Error	SMS Command Watchdog OK

To configure the GSM Warning Message options, select the “nanoLC… Configuration” menu.

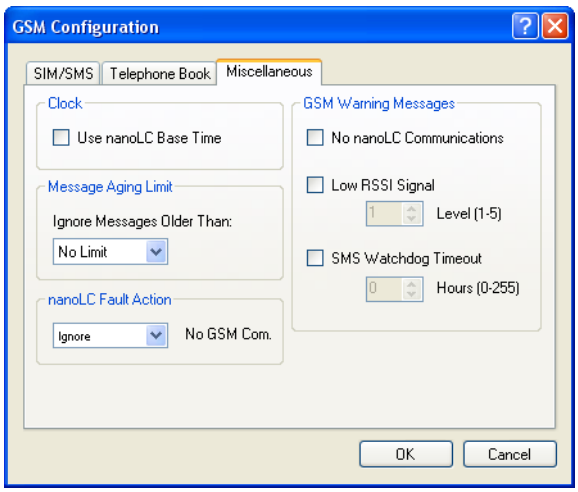

Figure 3-5 “GSM Configuration… Miscellaneous” dialog box

To activate the sending of a warning message, click the check box for the appropriate message (see Table 3-1). In addition to the check box, a value needs to be entered for the **Low RSSI Signal** and **SMS Watchdog Timeout** conditions.

When the “SMS Watchdog Timeout” box is checked, the nanoLC expects to receive an SMS message within the selected time period or else a warning message is generated. This is repeated for each timeout period until a message is received. A value between **0** hours to **255** hours must be entered using the drop-down menu.

Selecting 0 hours as the SMS Watchdog Timeout will result in a warning message being sent once each time the nanoLC is powered up.

The Low RSSI Signal value ranges from **1** to **5** with **1** being the lowest signal strength and **5** being the highest. The RSSI signal is evaluated during idle times. If the signal is found to be below the threshold for a one hour period, the fault message is generated. If a low RSSI

signal is sent and then the RSSI signal returns to be above the minimum threshold for 15 minutes, the recovery message is sent. In addition to the message, the LEDs on the module will flash to indicate signal strength (see “LED Indicators” on page 2-7).

For example, if the RSSI signal value is set to 4, the warning message is sent when the RSSI signal strength drops below 4 after an hour of being at that level. If the signal strength returns to four or above and remains there for 15 minutes, the recovery messages sent.

For comparison, think of the RSSI Signal value as the number of bars on a cell phone. When the signal strength is no longer at 4 bars, a warning message is sent by the module.

Base Unit Messages

In addition to the NLC-COM-GSM module conditions, messages can be sent concerning nanoLC base unit conditions (Table 3-2). nanoLC base conditions can be handled in one of three ways: they can be ignored, a warning message can be generated (the device continues to function) or fault message generated (the device stops and power must be cycled in order to return to normal operation). Select the desired method using the appropriate “nanoLC Fault Action” drop-down menu.

Refer to the *nanoNavigator Software Manual* for information on configuring the base conditions as either a warning or fault.

Table 3-2 nanoLC Conditions

Condition	Configurable?	Warning Message[1]	Fault Message[1]
Start-up tests	No		Start-up Test Error. System Stopped
No base project	No		Base Fault: No Project
Incorrect base project	No		Base Fault: Wrong Base
I/O Expansion	No		Base Fault: I/O expansion Fault
RTC not functioning	Yes	Base Warning: No RTC Module	Base Fault: No RTC Module
RTC battery failure	Yes	Base Warning: RTC Battery Fail	Base Fault: RTC Battery Fail
Operator Panel failure	Yes	Base Warning: No LCD Module	Base Fault: No LCD Module
Communication Module failure	Yes	Base Warning: No COM Module	Base Fault: No COM Module
Retentive fault	No		Base Fault: Retentive Fault
RTU timeout has expired	Yes	Base Warning: Serial RTU Timeout	Base Fault: Serial RTU Timeout
Wrong project version	No		Base Fault: Wrong Project Version

[1] *Blank indicates that the condition does not generate a message*

For base unit conditions configured as a fault, the project will stop executing, turning off all outputs. The power must be cycled to return normal operation.

Base unit warning and fault messages are also provided to the Operator Panel, if installed.

If a failure occurs, the base unit and NLC-COM-GSM module may not communicate and therefore, the base unit cannot initiate the message. If the base unit and NLC-COM-GSM module cannot communicate, the NLC-COM-GSM module will generate a message stating that it has lost communication with the base unit. When communication is re-established, a message stating such will be generated.

Fault and warning messages are only sent once. If the nanoLC is rebooted and the condition remains, a new message will be generated. Also, SMS watchdog timeout warnings are sent for every watchdog cycle.

3.2.3 Options

Time

To utilize the time from the GSM network, leave the “Use nanoLC Base Time” box unchecked (see Figure 3-5). The network time will be transferred to the nanoLC base unit at power up.

Click the “Use nanLC Base Time” check box to enter a time in nanoNavigator and transfer the time to the base unit.

Message Aging

To prevent the NLC-COM-GSM module from receiving and executing old read/write commands, select a time from the “Message Aging Limit” drop-down box. Options range from 5 minutes to 1 year (see Figure 3-5). Only messages with a time stamp of less than the selected value will be executed.

Message aging compares send and receive times within the SMS message, and does not relate to the time setting in the nanoLC. The SMS message includes time zone and daylight saving time information, allowing message aging limits to function regardless of location.

4 Control Messages

4.1 SMS Messages

NOTE:
If no telephone numbers are entered in the telephone book, the NLC-COM-GSM module is “open” to anyone who knows the telephone number. Restriction of incoming calls only occurs if a number is entered in the “Phone Number” field and the corresponding “Permit” check box is clicked.

Control messages can be **received** by the NLC-COM-GSM module to **read** or **write** (R/W) flags, timers, counters, registers, outputs, and inputs (inputs are read only). Confirmation control messages are also **sent** by the NLC-COM-GSM module in response to R/W requests to inform the original sender of the message of the actions taken.

– To allow a telephone number to send control messages to the NLC-COM-GSM module, enter the telephone number in the “Phone Number” field in the “Telephone Book” tab and click the “Permit” check box (see Figure 3-2). Successful **read** commands create a reply message to the requesting telephone number, even if the “w/Confirm” box is not checked.
  – To configure a telephone number to receive confirmation of control messages, enter the telephone number in the “Phone Number” field in the “Telephone Book” tab and click the “w/Confirm” check box. These telephone numbers receive confirmation SMS messages of successful or failed read and write commands.

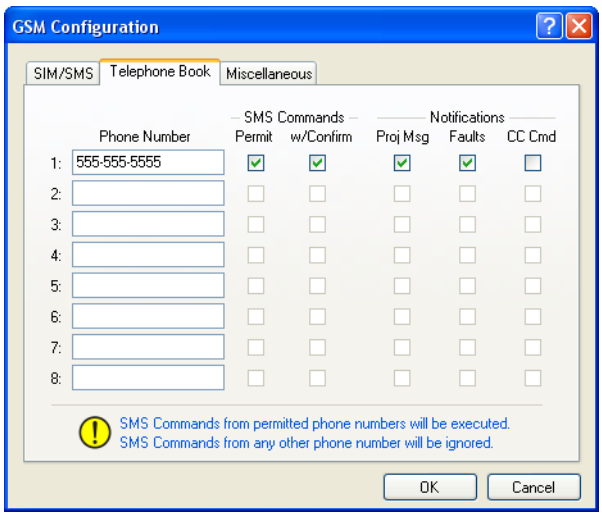

Figure 4-1 “GSM Configuration… Telephone Book” dialog box

The “Permit” and “w/Confirm” check boxes are typically applied to the same telephone number to ensure the sender of the request receives confirmation that their control message was received and correctly completed.

Confirmation messages are provided only to the requesting telephone number, even if multiple numbers are selected. To send messages to non-requesting numbers, use the “CC Cmd” check box.

Successful **read** requests are returned to the requestor without requiring the “w/Confirm” box to be checked.

The “w/Confirm” box is normally unchecked when the messages are exchanged between computers/controllers because the receiving device would not be able to evaluate the confirming message.

When exchanging data between two nanoLC controllers, the nanoLC receiving the write command must have the “w/Confirm” and “CC Cmd” boxes unchecked. Because confirmation messages are not recognized, a Command Failed message would be returned in response to the Confirmation message.

The “w/Confirm” box can also be unchecked to save money, if the data plan uses a per message pricing plan for each SMS message.

Message format to NLC-COM-GSM

The format of the messages is:

```
[<password>] <command> <data item type> <ID> [=<value>]
```

where:

[<password>] is the password field (only required if initially enabled through nanoNavigator). No spaces are allowed within a password.

Items within brackets ([ ])indicate an optional item

<*command*> is either an “R” (read) or “W” (write) character.

<*data item type*> is the symbol association with the Data Item Type on the nLC.

<*ID*> is the specific instance of the data item type. Multiple IDs may be entered in a single message provided each one is separated by a space.

[=<value>] is the subsequent value that is to be written by the nanoLC in a **write** command.

The password is case-sensitive and accepts upper and lower-case characters. The command and data item type fields must be entered as upper-case characters.

Not all data types can be written. Table 4-1 shows the available SMS data symbols, the corresponding nanoNavigator Data Item Type, and if the data type is read/write or read only.

Table 4-1 Data Types

Description	SMS Data Symbol	nanoNavigator Data Item Type	Read/Write
Digital Input	DI	I	R
Digital Output	DO	Q	R/W
Flag	F	F	R/W
Analog Input	AI	AI	R
Analog Output	AO	–	R/W
Register	R	R	R/W
Timer/Counter Preset[1]	TCP	TC	R/W
Timer/Counter Accumulator[2] [3]	TCA	TC	R/W
Output Timer Duration (Preset)[1]	OTP	TC	R/W
Output Timer Accumulator[2]	OTA	TC	R/W

1 *Preset references the value that the timer is set to.*

2 *Accumulator references the current value of the timer when the message is sent.*

3 *Timer/Counter Accumulators configured as HH:MM:SS and MM:DD:YY lose their format when sent in an SMS message. See "Formatted Data Item Types" on page 4-6 for more more information.*

Available data types vary based on the configuration of the nanoLC.

Message format from NLC-COM-GSM

A reply message from the NLC-COM-GSM module will have the format:

```
[<start delimiter>]<response> [<stationID>] <command> <data
item type> <ID> [=<values>][<end delimiter>]
```

where:

[<start delimiter>] signifies the beginning of the message (see "Command Response Delimiters" on page 3-2).

<*response*> is the acknowledgement of the message. The acknowledgement will be:

– "Command Executed" to indicate proper execution.

– "Command Failed <reason>" to indicate the message request was not properly executed and, if possible, provides a reason. Possible reasons are listed in Table 4-2.

[<stationID>] is the station ID of the module. If no station ID is entered in the project, this is blank.

<*command*> is the same as what was entered in the message request, either "R" (read) or "W" (write).

<*data item type*> is the symbol association with the Data Item Type on the nanoLC.

<*ID*> is the specific instance of the data item type. Multiple IDs may be entered in a single message provided each one is separated by a space.

[=<values>]is the subsequent value that was written by the nanoLC.

[<end delimiter>] signifies the end of the message (see "Command Response Delimiters" on page 3-2)

Table 4-2 Command Failed Reasons

Error String	Reason
Command Failed: BaseCommsFailure	Communication between the NLC-COM-GSM and base unit failed
Command Failed: Expired	Allowable time to receive a message has expired
Command Failed: SIM	SIM card storage failed
Command Failed: Command	R or W command not detected
Command Failed: Password	Invalid password
Command Failed: Command DataType Mismatch	Command invalid for data item type (e.g., W DI)
Command Failed: DataType	Invalid data type (e.g., not DO, DI, etc)
Command Failed: DataPoint	Invalid data ID value
Command Failed: Password Size	Change password failed because it was less than four characters
Command Failed: No Password	Change password failed. The password must be set at initial bootup or it cannot be entered.

The following provides several sample messages showing message format and possible response messages from the NLC-COM-GSM module.

4.1.1 Examples

Example 1 – Read

To read the output value from Q-00 from an SMS-capable device, such as a telephone or controller, type

```
R DO 0
```

The nanoLC will respond as follows:

```
Command Executed R DO 0=1
```

where 1 is the status stored in Q-00, indicating the output is on (if output Q-00 was off, this would read 0=0).

Digital data items (inputs, outputs, flags) use **1** to indicate true or on and **0** to indicate false or off.

If the nanoLC cannot complete the command, the response will be as:

```
Command Failed: <xxxx> R DO 0=1
```

where xxxx is the reason for the failure (see Table 4-2).

Example 2 – Read with SMS Password

To read the output value from Q-00 from a nanoLC that uses an SMS Password (see Figure 3-1) of **1e4ba**, type

```
1e4ba R DO 0
```

The nanoLC will respond as follows:

```
Command Executed R DO 0=1
```

Example 3 – Write

To write an output value to Q-00 (make it true), type

```
W DO 0=1
```

The nanoLC will respond as follows:

```
Command Executed W DO 0=1
```

Example 4 – Write with Station ID

To write an output value to Q-00 (make it true), type

```
W DO 0=1
```

If the nanoLC configuration includes a Station ID (see Figure 3-1) of **Unit_1**, the response would be:

```
Command Executed Unit_1 W DO 0=1
```

The Station ID is only included in the response from the nanoLC.

Example 5 – Read Multiple Values

To read the flag status of F-02, F-03 and F-06, type

```
R F 2 3 6
```

The nanoLC will respond as follows:

```
Command Executed R F 2=1 3=1 6=0
```

where 2=1, 3=1 and 6=0 are the statuses stored in F-02, F-03 and F-06 (flags 2 and 3 are on and flag 6 is off).

Example 6 – Read Multiple Values with Delimiters

To read the flag status of F-02, F-03 and F-06, type

```
R F 2 3 6
```

If the nanoLC configuration included a start delimiter of **/ *** and an end delimiter of ***/** (see "Command Response Delimiters" on page 3-2), the response would be:

```
/*Command Executed R F 2=1 3=1 6=0*/
```

The command delimiters are only included in the response from the nanoLC.

Example 7 – Write Multiple Values

To write the register values for R-00, R-01 and R-04, type

```
W R 0=3 1=2457 4=240
```

where R-00 becomes 3, R-01 becomes 2457 and R-04 becomes 240.

The nanoLC will respond as follows:

```
Command Executed W R 0=3 1=2457 4=240
```

Example 8 – Write Multiple Values with SMS Password, Station ID and Delimiters

To write the register values for R-00, R-01 and R-04 to a nanoLC controller that uses an SMS Password of **1e4ba**, Station ID and delimiters, type

```
1e4ba W R 0=3 1=2457 4=240
```

If the nanoLC configuration included a Station ID of **Unit_1**, a start delimiter of **/ *** and an end delimiter of ***/**, the response would be:

```
/*Command Executed Unit_1 W R 0=3 1=2 4=240*/
```

4.2 Formatted Data Item Types

There are a few Data Item Types that require special handling when sending Control messages. These involve special formatting in either an HH:MM:SS (Time) or MM:DD:YY (Date).

Within the nanoLC controller, the formatting for these Data Item Types are stored in a 32-bit format divided into four bytes using a binary number system. Each field corresponds to a byte (see Figure 4-2).

When a Data Item Type with this format is sent in an SMS message, the message structure cannot maintain the nanoLC formatting and is converted to a base-10 decimal value.

If the Control message is sent to a device that can convert the decimal value to a binary value, as most computers and PLCs can, it can be configured so the user sees the original format (HH:MM:SS).

If the message is sent to an SMS-capable telephone, the user will need to convert the decimal value manually. Many calculators (including Microsoft® Calculator included with the Windows® operating system) are capable of this conversion. Enter the decimal value in ”decimal” mode (DEC) and then change to binary mode (BIN).

Example

To read the Timer/Counter Value of TC-03, which is configured to use the HH:MM:SS format, type

```
R TCA 3
```

The nanoLC will respond as follows:

```
Command Executed R TCA 3=726583
```

where 726583 is the decimal equivalent of the value stored in TC-03. This decimal value must be converted to a binary format to determine the actual time value in an HH:MM:SS format. Figure 4-2 shows the conversion process.

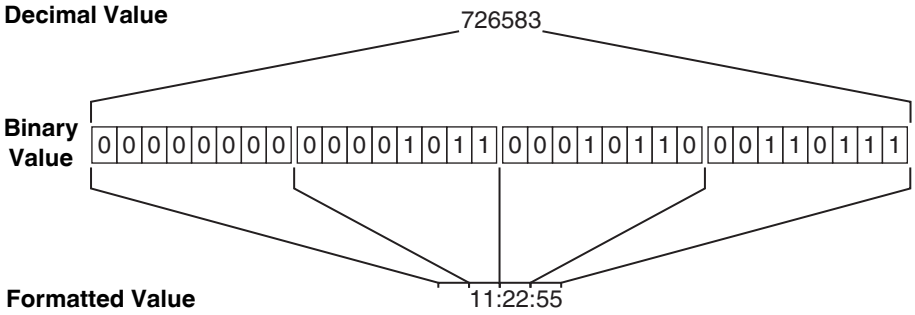

Figure 4-2 Data Item Type nanoLC to SMS Message

4.3 SMS Password Change

In addition to the read/write commands for accessing/writing data, a user with proper rights can change the SMS password from telephone numbers with the “Permit” box checked.

The SMS password is only loaded when the nanoLC is first powered.

The format for this command is:

```
<password> <CP> <passwordnew>
```

where:

<*password*> is the password field.
<*CP*> is the command “Change Password.”
<*passwordnew*> is the new password.

The nanoLC will respond, if the “w/Confirm” box is checked, with the status message

```
Command Executed
```

to indicate proper execution. If the command failed, the message

```
Command Failed <reason>
```

will indicate the message request was not properly executed and, if possible, provide a reason for the failure (see Table 4-2).

The SIM Card PIN cannot be changed.

5 Sample Project

This section guides a user through an sample project to highlight use of the NLC-COM-GSM module. A familiarity with the nanoLC and programming with nanoNavigator is assumed.

5.1 Requirements

The following is required to configure and use the NLC-COM-GSM module:

- nanoLC base unit with firmware 1.02 or higher (included with nanoNavigator 2.1 and higher).
- NLC-COM-GSM module (Order No. 2701344).
- base unit option module to communicate between the base unit and the PC (Order No. 2701195 for USB, 2701179 for RS-232, 2701185 for RS-485).
- 24 V DC power source for the NLC-COM-GSM module and base unit (for base unit Order No. 2701069 a 120 or 230 V DC power source is required).
- PC with nanoNavigator 2.1 or higher installed. This can be downloaded from www.nanoNavigator.com.
- SIM card with text plan to allow SMS messaging.
- Telephone with SMS messaging capability to send and receive messages to the nanoLC.

5.2 Installation

To install the NLC-COM-GSM module:

1. Follow the packing slip instructions and assemble the nanoLC components.
2. Connect power to the base unit and NLC-COM-GSM module.
3. Apply power to the nanoLC and NLC-COM-GSM module. The nanoLC Power LED should illuminate and the Operator Panel, if present, should show status information about the nanoLC.

   On the NLC-COM-GSM module, the red Error LED will come on and stay on because there is not a valid configuration loaded in the NLC-COM-GSM module.

If the system was used before, there may be a valid configuration in the NLC-COM-GSM module. In this case the red Error LED will come on briefly, then turn off.

4. Start nanoNavigator and click the “Create a new Project” button on the “nanoNavigator Startup” dialog box.

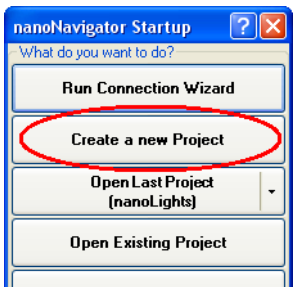

Figure 5-1 “Create a new Project” button

5. From the “nanoLC Configuration” dialog box, select the nanoLC base from the “Base Unit” drop-down menu. Additional settings may be made after clicking the “Configure” button.
6. From the “nanoLC Configuration” dialog box, select the NLC-COM-GSM module from the “COM Interface” drop-down menu.

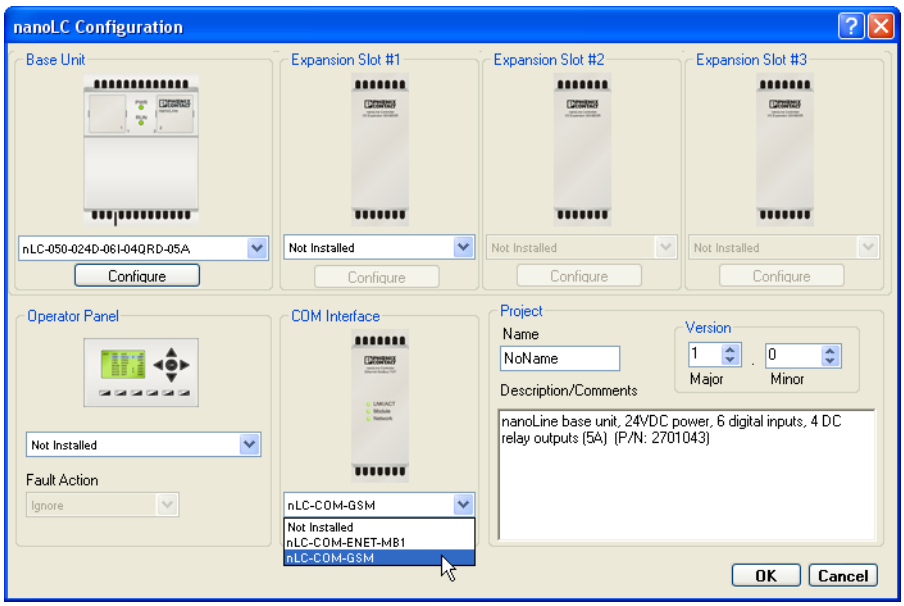

Figure 5-2 Selecting the NLC-COM-GSM module

7. Click the “Configure” button to open the “GSM Configuration” dialog box. Click the “SIM/SMS” tab and enter the SIM card PIN number in the “SIM Card PIN” number field, if applicable. This is provided by the GSM network service provider. Refer to “Passwords” on page 3-1” for information concerning other fields.

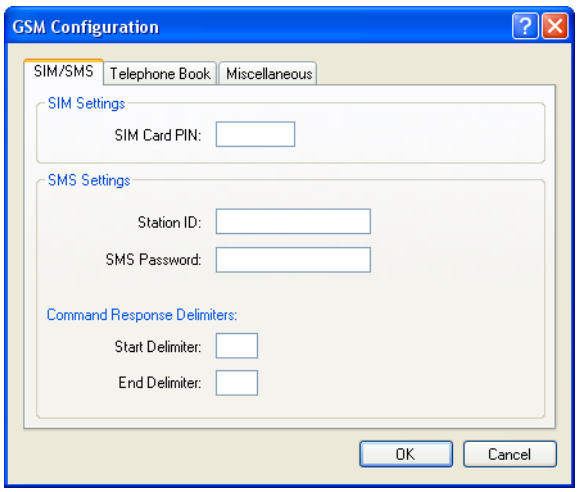

Figure 5-3 “GSM Configuration… SIM/SMS” dialog box

8. Click the “Telephone Book” tab. The telephone book determines:
   – which telephone numbers are accepted.
   – where fault and warning messages are sent.
   – which telephone numbers can send read/write commands.
   – where project messages are sent.

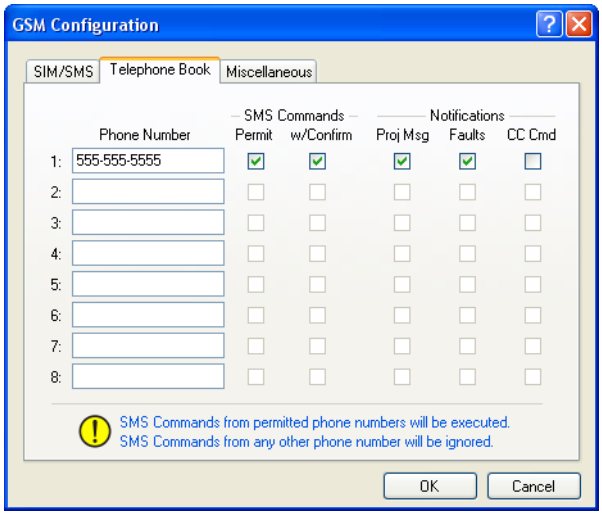

Figure 5-4 “GSM Configuration… Telephone Book” dialog box

Each line references a single telephone number. The various check boxes on the line configures the NLC-COM-GSM module to send or accept specific types of messages from that telephone number.

NOTE:
If no telephone numbers are entered in the telephone book, the NLC-COM-GSM module is “open” to anyone who knows the telephone number. Restriction of incoming calls only occurs if a number is entered in the “phone number” field.

For this example, do the following:
– Phone number: Enter the number for the telephone that will be used to send and receive messages.
– Permit: Place a check in this box. This configures the nanoLC to **accept** read and write commands from this number. Read message replies are also sent to this number.
– w/Confirm: Place a check in this box. This configures the nanoLC to **send** confirmation of write commands to this number.
– Proj Msg: Place a check in this box. This configures the nanoLC to receive messages created and called by the project as it is running. These messages are created in the Message Editor.
– Fault: Place a check in this box. This configures the nanoLC to send any warning and fault messages to this number.
– CC Cmd: Do not place a check in this box. This configures the nanoLC to send confirmation of read/write commands from other telephone numbers to this telephone number.

– Click the “Miscellaneous” tab to verify settings. For the purpose of this example, the default settings are sufficient. Refer to “System Messages” on page 3-6” for information concerning specific fields.

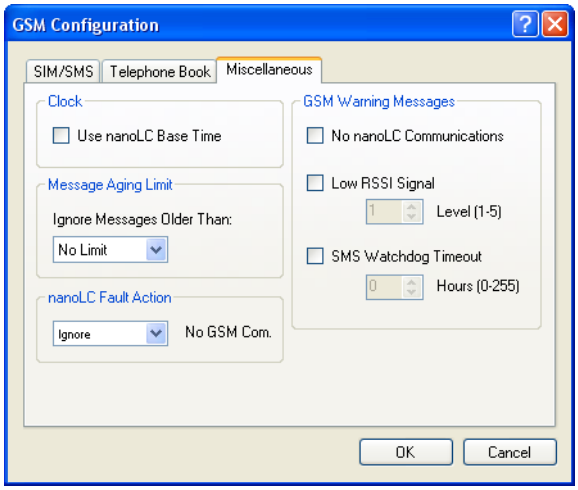

Figure 5-5 “GSM Configuration… Miscellaneous” dialog box

9. Click the “OK” button when finished configuring the NLC-COM-GSM module. Click the "OK” button to close the “nanoLC Configuration” dialog box. When closed, a prompt appears to “Select Type of First Chart.” Click the “Create Flow Chart” button.

10. Click the “Message Editor” icon and create a message. Click the “Comm. Expansion” check box to send the message to the NLC-COM-GSM module when the project calls the message. Click the “Save” button, then click the “Close” button.

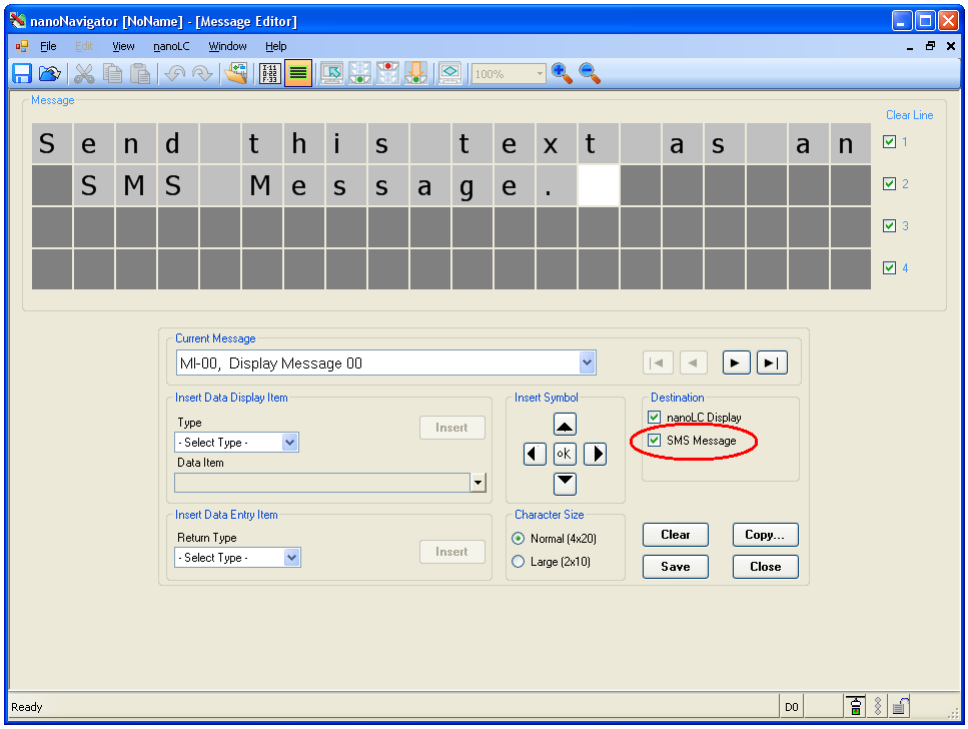

Figure 5-6 Message Editor

11. Create the flow chart shown in Figure 5-7 using the chart editor.

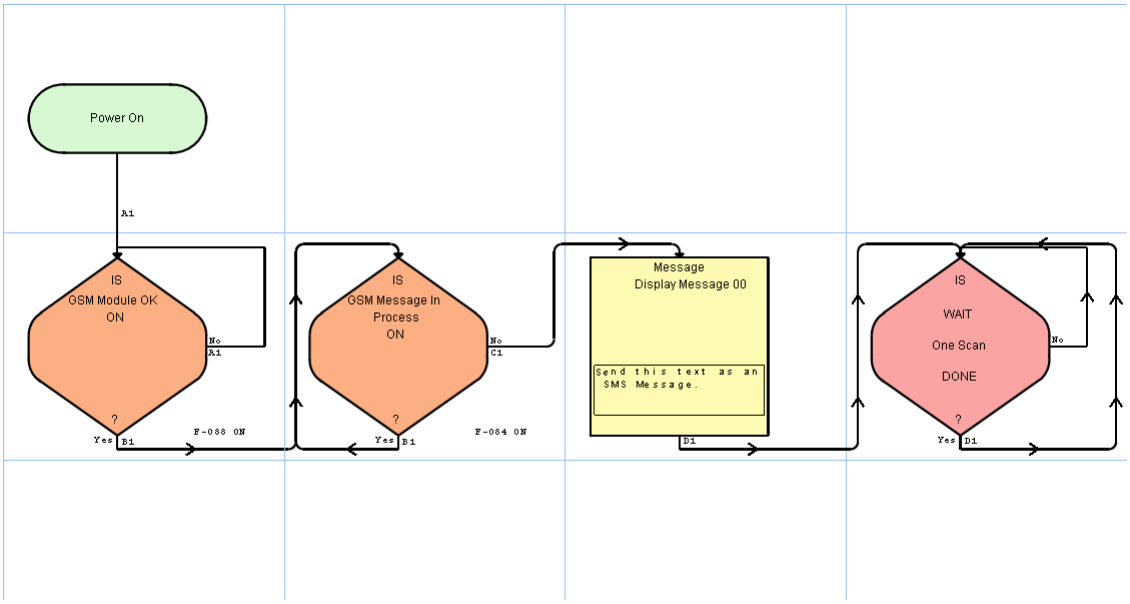

Figure 5-7 Flow chart to send an SMS message

This project sends one message and then stops. The following explains the content of each cell:

– Cell A1 provides a test to verify that the NLC-COM-GSM module is OK. It controls **Flag 88**.
– Cell B1 provides a test to verify that the NLC-COM-GSM module is not busy sending another message. It controls **Flag 84**. Communication within the nanoLC controller is much faster than GMS network speed. If multiple messages are received at the NLC-COM-GSM module, it will stop sending the current one (before finishing) and begin sending the most recent message.
– Cell C1passes the message from the base unit to the NLC-COM-GSM module to be transmitted along the GSM network.
– Cell D1 provides a Wait block to finish the program.

12. Save the project.
13. Click the “Download & Go” button. The project will download into the attached nanoLC controller and a monitor window will automatically open.

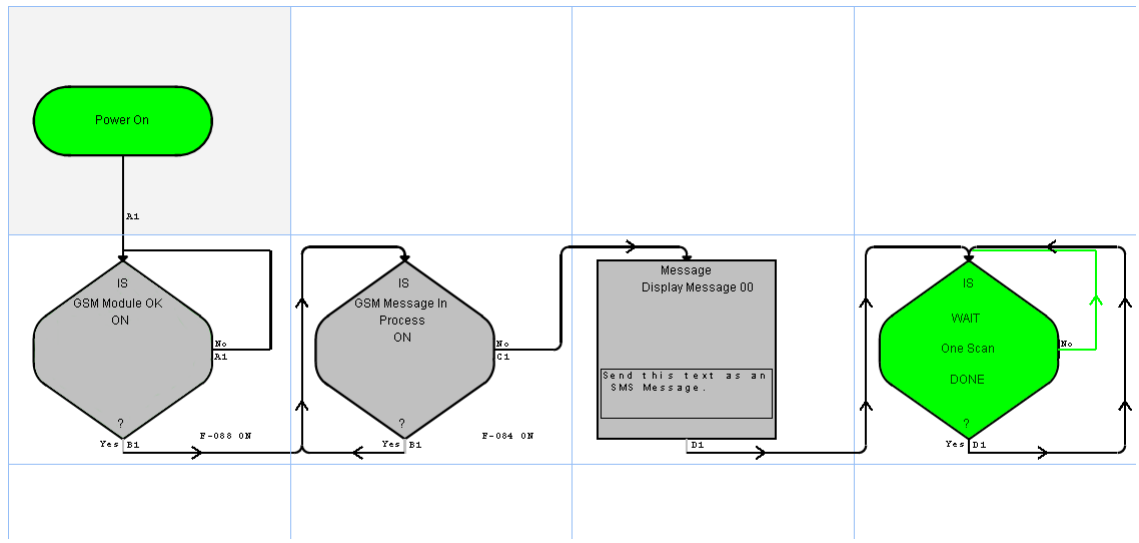

Figure 5-8 Flow chart running in Monitor window

14. The monitor window will follow the progress of the project execution and end at the Wait block.

    After execution, the following should occur to indicate a successful project message transfer:

    – the red Error LED on the module will appear briefly, indicating the new configuration is transferred.
    – the green Signal LED will indicate the strength of the signal. If the LED is off, the NLC-COM-GSM module was unable to locate and connect to the GSM network. If so, check the antenna connection. If connection is OK, move the controller to an area with better network connection.
    – the green Net Status LED should flash (1/3 on, 2/3 off) indicating the module is connected to the network.
    – the specified telephone should receive the “**Send this text as an SMS message**” message.

15. To confirm message delivery to the NLC-COM-GSM module, reply to the message received with the text "**R R 1**". If the NLC-COM-GSM module receives the message, it will reply with the "**Command Executed R R 1=0**" message.

Use of the reply feature on the telephone will ensure that the correct telephone number is entered. If the telephone does not have a reply feature, ensure that the number of the NLC-COM-GSM module is entered correctly.

If no reply message is received, check the configuration of the telephone number in the "GSM Configuration... Telephone Book" dialog box. Verify the following:

– the "Permit" box is checked next to the correct telephone number.
– no abbreviations are entered in the "Phone" field.

After making corrections, repeat the process from step 13 (Download & Go).

16. If messages from the telephone are still not being accepted by the NLC-COM-GSM module, uncheck all "accept" check boxes. This will allow the nanoLC to accept calls from all telephone numbers. Repeat the process from step 13 (Download & Go).

    If this does not allow the message to go through, there is a problem with the sending telephone. Either it is not SMS-capable or the data plan does not include a data or text plan.

A Technical Appendix

A 1 Ordering Data

Products

Description	Type	Order No.	Pcs./Pkt.
nanoLine GSM communications module, 12 to 24 V DC input power, modem	NLC-COM-GSM	**2701344**	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
Antenna, dual-band, omni-directional, 2 m cable, SMA connector (male)	PSI-GSM-900/1800-ANT	**2708902**	1
Antenna, quad-band, omni-directional, 2 m cable, SMA connector (male)	PSI-GSM/UMTS-QB-ANT	**2313371**	1
End bracket, to screw on NS 35	E/NS 35 N	**0800886**	50

A 2 Technical Specifications

General	
Dimensions (H x W x D)	103 x 80 x 60 mm
Weight	140 g
Degree of protection	IP20
Operating temperature range	-25…55°C
Storage temperature range	-25…85°C
Humidity (maximum) @ 25°C	90%

Supply Voltages	
Power supply (nominal)	12…24 V DC
Power permissible range (ripple included)	9.6…28.8 V DC
Current consumption - transmitting (typical)	
12 V	223 mA
24 V	120 mA
Current consumption - registered idle (typical)	
12 V	80 mA
24 V	50 mA
Connection	Screw

Transmit Data	
Frequency	Quad band EGSM 850, 900, 1800, 1900 MHz
Power output	
850, 900 MHz	2 W
1800, 1900 MHz	1 W

Interface	
SIM Card	6 pin, 3 V
Communication method	GSM
Antenna connection	SMA-F
Antenna requirements	
Power	>2 W
Gain	<3 dBi
Impedance	50 Ω
Recommended VSWR	≤2:1
Required VSWR	≤10:1

B Technical Appendix – System Flags

nanoLC has predefined system flags that provide status information during project execution. These flags are available through nanoNavigator. The flags that appear in the Data Item Editor depend on the configuration options specified. Additional flags can be found in the *nanoNavigator User Manual*.

B 1 NLC-COM-GSM Flags

There are eight flags associated with the NLC-COM-GSM module. They are:

Table B-1 NLC-COM-GSM Flags

Flag	Name	Description
F-72	GSM Command 00 (Reserved)	Reserved for future use
F-73	GSM Command 01 (Reserved)	Reserved for future use
F-74	GSM Disable Port	Disables the GSM port from remote access from outside network sources.
F-75	GSM Command 03 (Reserved)	Reserved for future use
F-76	GSM Command 04 (Reserved)	Reserved for future use
F-77	GSM Command 05 (Reserved)	Reserved for future use
F-78	GSM Command 06 (Reserved)	Reserved for future use
F-79	GSM Command 07 (Reserved)	Reserved for future use
F-80	GSM Command 08 (Reserved)	Reserved for future use
F-81	GSM Command 09 (Reserved)	Reserved for future use
F-82	GSM Command 10 (Reserved)	Reserved for future use
F-83	GSM Command 11 (Reserved)	Reserved for future use
F-84	GSM Message in Process	True when NLC-COM-GSM module is sending SMS message. To ensure delivery of previous message, wait until this flag is false.
F-85	GSM Command 13 (Reserved)	Reserved for future use
F-86	GSM Command 14 (Reserved)	Reserved for future use
F-87	GSM Command 15 (Reserved)	Reserved for future use
F-88	GSM Module OK	True when NLC-COM-GSM module is available.
F-89	GSM SIM Card Fault	True when SIM card has a fault.
F-90	GSM Status 02 (Reserved)	Reserved for future use
F-91	GSM Status 03 (Reserved)	Reserved for future use
F-92	GSM Low Signal Fault	True when wireless signal is less than fault value.
F-93	GSM Watchdog Timeout Fault	True when the SMS Watchdog Timeout value is exceeded.

Table B-1 NLC-COM-GSM Flags

Flag	Name	Description
F-94	GSM Status 06 (Reserved)	Reserved for future use
F-95	GSM Status 07 (Reserved)	Reserved for future use
F-96	GSM Status 08 (Reserved)	Reserved for future use
F-97	GSM Status 09 (Reserved)	Reserved for future use
F-98	GSM Status 10 (Reserved)	Reserved for future use
F-99	GSM Status 11 (Reserved)	Reserved for future use
F-100	GSM Status 12 (Reserved)	Reserved for future use
F-101	GSM Status 13 (Reserved)	Reserved for future use
F-102	GSM Status 14 (Reserved)	Reserved for future use
F-103	GSM Status 15 (Reserved)	Reserved for future use

C Appendices

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