



ComTroll[®] 333 ICU

Indicator Communication Unit

User Manual

ComTroll[®]



This document describes the Installation- and setup procedure for COMTROLL 333 Indicator Communicator Unit with GSM Communication.

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1. Introduction

The ComTroll® 333 ICU is designed as a general GSM communication interface to applications for fault-detection and fault management such as earth-fault and short-circuit indicators and line protection equipment.

ComTroll® 333 communicates with the SCADA system through the ComTroll 120 GSM LON Router using SMS.

NorTroll offers a complete SCADA solution with NetTroll MicroScada for configuration, control, monitoring and automation of the ComTroll® 333 Terminals.

The unit can be used as a standalone digital/analog interface to any equipment providing a relay output and analog output for alarms and indications and is ideal as an extension to NorTroll's **QuickLink** short range radio system for remote indication of faults on the MV voltage distribution network.

System overview

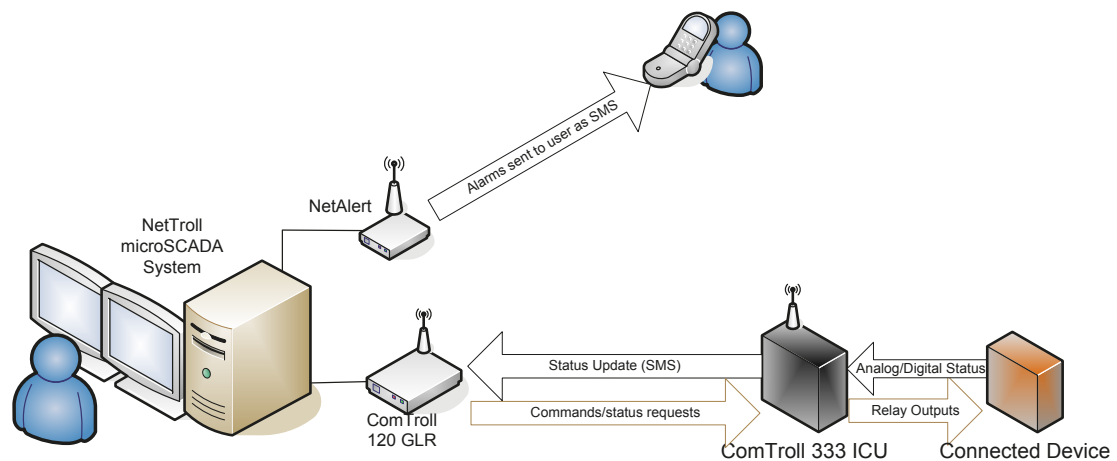


Figure 1; ComTroll 333 ICU System overview.

Control and monitoring

ComTroll 333 ICU must be programmed with a receiver number before it can send any SMS messages. This is done during configuration and set-up.

Only one receiver number can be programmed into the device. This number is usually the ComTroll 120 GLR telephone number.

The ComTroll 120 GLR interfaces all 333 ICU devices in the network to the NetTroll microSCADA system.

A status request can be sent to the ComTroll 333 ICU from a different number than the primary receiver number (central unit) e.g. from a cell-phone providing a correct password. In this case, the status will be sent back to the sender of the status request. No status will be sent to the primary receiver number.

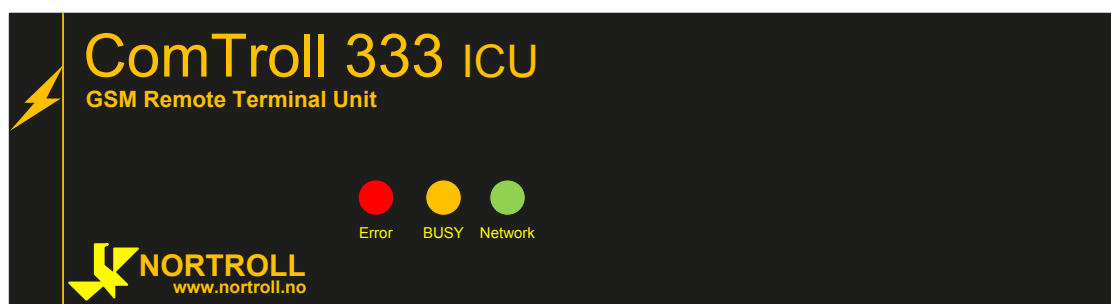
The ComTroll 333 ICU is fitted with 4 relay outputs which can be operated remotely by sending an SMS providing the correct password is used. In systems where the ComTroll 333 ICU is connected to the QuickLink remote indicator system, the outputs can be used to send TEST and RESET signals to the QuickLink collector to verify the signal path all the way between the phase mounted indicators and back to the control center. The commands will also be executed when sent from a cell-phone or another SMS sending device, even if the sender is not the primary recipient number. The reply on the command (status on the digital and analog inputs) will be sent to both the number from where the command came from as well as the primary recipient number.

The ComTroll 333 ICU will periodically send its analog and digital status in a configurable time interval. This mechanism is also called Heartbeat. If the heartbeat messages are not received by the NetTroll microSCADA, an alarm will be raised to indicate a faulty device or a bad communication link.

Any status change on the connected device (digital status) will be reported back to the central unit without any polling/status request sent from the central. (Report-by-exception). Analog status will be sent upon request from the central (or cell-phone providing a correct password) or periodically (heartbeat).

2. Hardware description

ComTroll 333 ICU front panel



The Indicator Communicator Unit does not have any buttons for local control of the output relays.

LED Indications

ERROR: The LED will be ON when:
 The SIM card is missing or PIN is activated. (NETWORK is flashing green).

No connection between CPU and GSM Module (NETWORK is flashing red).

NETWORK: Flashing green: Good signal.
 Flashing red and green: Medium signal.
 Flashing red: Bad or no signal at all. The antenna should be repositioned

BUSY: ON when sending / receiving SMS.

Hardware Setup

Preparing the SIM Card

The PIN code must be deactivated before inserting it in the SIM card socket. Insert it into a cell-phone and follow the procedure explained in the cell-phone manual.

If the PIN code is activated when powering the ComTroll 333 ICU, the red ERROR LED will be ON and the green NETWORK LED will flash.

Normally, SIM cards can be provided without PIN codes from the network operator.

Selecting the correct type of SIM card/subscription

We strongly recommend disabling voice feature on the SIM cards. Also, pre-paid SIM cards should not be used for this application.

Only SMS service should be enabled.

Inserting the SIM Card



Picture 1; Mounting SIM-card and antenna.

The SIM card is inserted as shown in the picture above. **Do not insert the SIM card when the 12Vdc power is connected.**

Connecting the antenna:

The type of external antenna will vary upon the application and the mounting site. External antenna must be ordered separately. The ComTroll 333 ICU comes with a short interface cable that is fitted directly into the connector on the telephone module as shown in Picture 1.

ComTroll 333 ICU Inputs and Outputs:

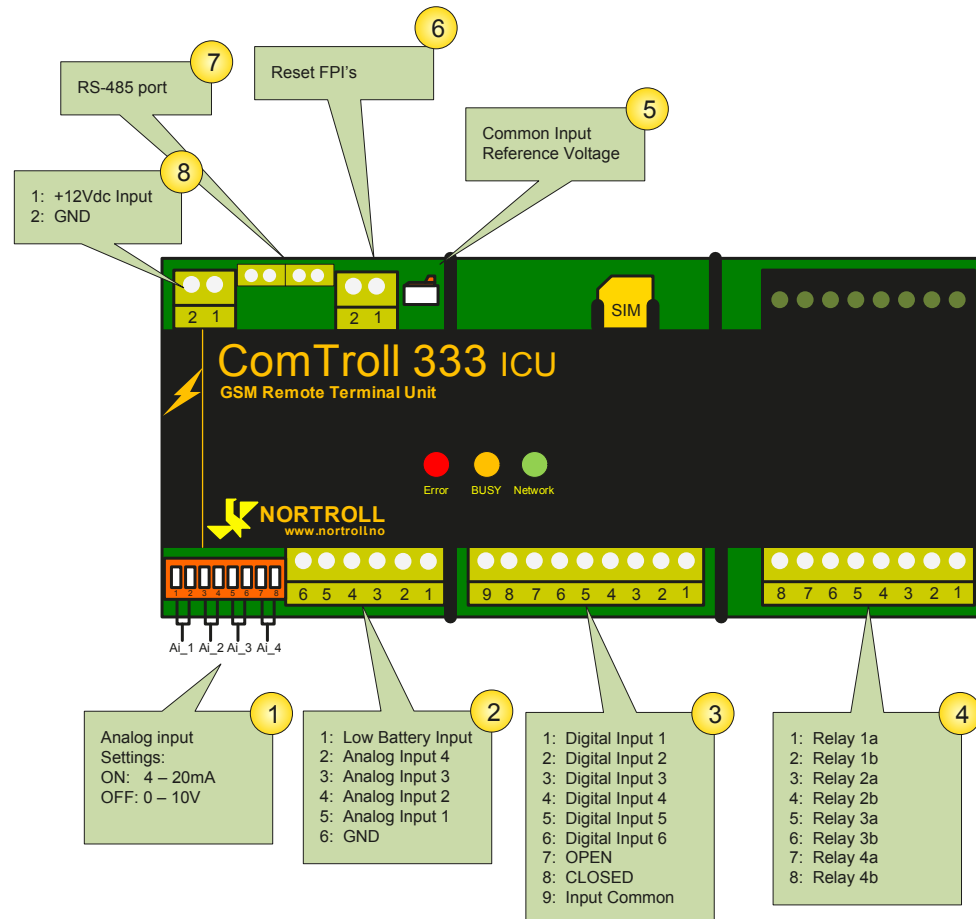


Figure2; Connectors and DIP Switches on ComTroll 333 ICU

- 1: The ComTroll 333 ICU has 4 analog inputs that offers 10 bit resolution, and can be individually programmed according to the incoming signal. It can be set to 0 – 10V or 4 – 20mA. The inputs are read when the user sends a status request or when the ComTroll 333 ICU sends any other message, e.g heartbeat or when one or more of the inputs changes status.
- 2: The Low Battery Input is a digital input that activates a warning message when the input is shorted to GND. Please note that an external voltage relay must be used as

this is a digital input. This can also be used to monitor charging failure by connecting a voltage relay with a signal contact to this input. The Low Battery warning is sent as an SMS to the central unit. To avoid warnings upon short voltage drops, the SMS is delayed 60 sec.

If the normal battery voltage is restored within 60 seconds (or external charging is restored) no message will be sent.

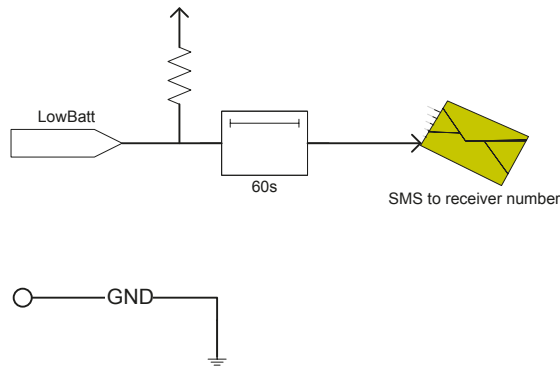


Figure 3; Low Battery Input

- 3: All of the 8 bipolar digital inputs are optically isolated and have the same physical layout. The user can define in the CONFIG command whether a SMS should be sent on the ACTIVE transition only or on both transitions.

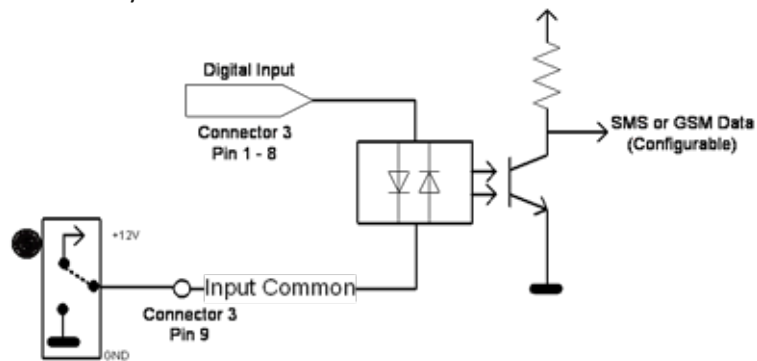


Figure 4; Digital input circuitry

The voltage applied on the digital inputs should not exceed 50V dc.

- 4: Relay 1 to 4 is general purpose normally open relays. The closing time can be set by the configuration command.
- 5: Select +12V or GND as the Common Input Reference Voltage. When this switch is in the +12V position, this voltage will be available on the Common input on connector block 3. In GND position, Common Input will be connected to GND. See figure 4 for details.
- 6: Reset FPI Input. Not Implemented.

7. Serial port with RS 485 interface. Not Implemented.
8. 12Vdc supply for the powering the ComTroll 333 ICU. The unit can be powered from a battery source with mains or solar charging. Max input voltage is 15Vdc.

3. Functional Description

Configuration

There are several parameters that need to be set before the ComTroll 333 ICU can be put into operation.

- ✓ Set the receiver phone number.
- ✓ Set operation mode
- ✓ Set the heartbeat interval
- ✓ Change the default password
- ✓ Set relay timeout
- ✓ Activate two or four analog inputs.

The configuration commands can be sent from any device that is capable of sending SMS.

When using the NetTroll MicroSCADA system, the configuration can be executed from the Network View. Please refer to the *Installation in NetTroll* chapter.

Set the receiver phone number.

Command	Set receiver phone number
Description	Set which phone number the device will use when sending alarms and messages. The phone number can be maximum 14 characters long. An error will be returned if the ComTroll 333 ICU is unable to extract a valid number from the command. T is a number from 1 to 9 that is added to the command to identify the response from the device. The response will return the same T as sent in the command.
Format	Password 0 phonenumbers T
Normal response	3 0 0 1 T
Error response	3 0 0 0 T

Set operation mode

Command	Configure Node
Description	<p>Sets configurable 5 character flag in ComTroll 333 ICU</p> <p>Char A: '0' = Send alarms when input 1 – 8 changes from 0→ Char A: '1' = Send alarms when input 1 – 8 changes from 0→ 1 and from 1→0</p> <p>Char B: Must be set to '1' in CmT333 ICU Char C: Must be set to '1' in CmT333 ICU Char D: Send two or four analog values. '0'=2; '1'=4. Char E: Not used in this version. Set to '0'</p> <p>All 5 characters must be sent.</p>
Format	Password 1 EDCBA T
Normal response	3 1 EDCBA 1 T
Error response	3 1 0 0 T

EXAMPLE: A commonly used configuration it to send a message on both the active and de-active transition as well as sending 4 analog values. The SMS that must be sent to the ComTroll 333 ICU will then look like: '**1234 1 01111 3**'. 1234 is the default password, 1 is the command, 01111 are the configuration and 3 the random number T.

Set the heartbeat interval

ComTroll 333 will send a heartbeat message to the central unit in a fixed interval that can be set by the user. The heartbeat message can be switched off by setting the time to 0000 hours.

Default time interval is 0072h.

Please note that setting the heartbeat interval to a short period will increase the operation cost.

Command	Set HeartBeat Intervall
Description	<p>Set the heartbeat interval in the range of 0000 and 9999 hours. Send always 4 characters in TIME variable. 0000 means heartbeat is switched OFF.</p> <p>Default value is 0072 hours.</p>
Format	Password 2 TIME T
Normal response	3 2 TIME 1 T
Error response	3 2 0 0 T

Change the default password

It is recommended to change the default password before the unit is installed in a live system.

Default password is 1234.

Command	Set new password
Description	ComTroll 333 will set the new password. The new password will be made effective immediately. An error will be returned if the CmT333 is unable to extract a valid password. The password must be exactly 4 characters long and include both numbers and letters. (Case sensitive).
Format	Password 8 NewPassword T
Normal response	3 8 **** 1 T
Error response	3 8 0 0 T

NOTE! If the new password is lost or forgotten it is possible to reset the password back to default by contacting NORTROLL AS.

Set relay timeout

Command	Set relay time
Description	Set the timeout value in for relay 1 – 4 in milliseconds. K = 2 ; Set active time for relay 1 – 4 XXXXX Time in milliseconds (E.g. 00500 = 500ms) Always type 5 characters.
Format	Password 4 K XXXXX T
Normal response	3 4 K xxxxxx 1 T
Error response	3 4 K xxxxxx 0 T

Deactivate Inputs

It is possible to deactivate individual digital inputs. If the corresponding flag is set, the input will not respond to status changes on the input and therefore not send any alarms to the receiver. This command is implemented in case the connected equipment fails, and the unit starts to send messages continuously.

Command	Deactivate Inputs
Description	<p>Sets configurable 8 character flag in ComTroll 333 ICU</p> <p>Each character corresponds with one of the eight digital inputs:</p> <p>Char H: Closed / Digital Input 8 Char G: Open / Digital Input 7 Char F: Digital input 6 Char E: Digital Input 5 Char D: Digital Input 4 Char C: Digital Input 3 Char B: Digital Input 2 Char A: Digital Input 1</p> <p>All 8 characters must be sent.</p> <p>Char x = 0 --> Input sends alarm upon status change Char x = 1 --> Input will not send alarms upon status change.</p> <p>DEAFULT VALUE: 00000000 [HGFEDCBA]</p>
Format	Password 7 HGFEDCBA T
Normal response	3 1 HGFEDCBA 1 T
Error response	3 1 0 0 T

Commands and status messages

There are two “commands” available in ComTroll 333 ICU:

- ✓ Request for status
- ✓ Set one of four relay outputs.

Both these commands can be sent from any cell-phone or from NetTroll microSCADA. The ComTroll 333 ICU only accepts commands sent by SMS providing the password and format is correct.

Request status.

Command	Request Status.
Description	Request status on digital inputs, internal mode status and the analog inputs.
Format	Password 5 T
Normal response (Two analog inputs)	A Status1 Status2 Analog1 Analog2 T
Normal response (Four analog inputs)	A Status1 Status2 Analog1 Analog2 Analog3 Analog4 T
Error response	N/A

Activate the relay outputs.

Command	COMMAND Switch and Relays
Description	The command is a number from 1 to 4 as follows: 1: Set Relay 1 (pulse length configurable) 2: Set Relay 2 (pulse length configurable) 3: Set Relay 3 (pulse length configurable) 4: Set Relay 4 (pulse length configurable)
Format	PASS 6 Command T
Normal response	A Status1 Status2 Analog1 Analog2 T (New Status)
Error response	A Status1 Status2 Analog1 Analog2 T (Old Status)

Status Message Definition

When the ComTroll 333 ICU is monitored from NetTroll microSCADA the messages are converted into messages defined by the user. In NetTroll microSCADA it is possible to assign a specific input to a specific text and symbol.

It is possible to assign special message sets for each device individually in NetTroll ver. 4.0 or newer.

In cases where the ComTroll 333 is controlled by a cell-phone or another GSM device it is necessary to know the message format definition:

The message that comes as a SMS follows the two conventions below:

When set to send two analog values:

A status1 status2 analog1 analog2

With set to send four analog values:

A status1 status2 analog1 analog2 analog3 analog4

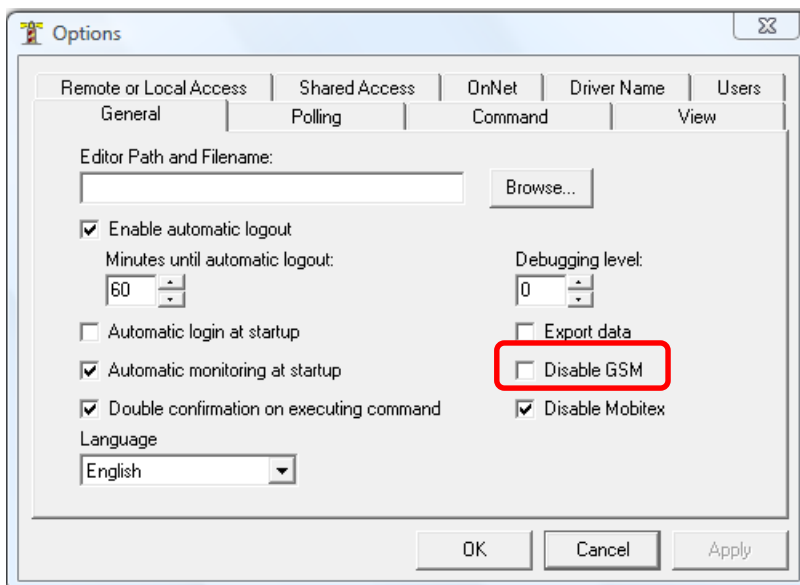
'A' is a Message Identifier and will always be added to a message from the unit.

BitNo	ComTroll 333 ICU	
Bit 0	Digital input 1	Status 1
Bit 1	Digital input 2	
Bit 2	Not used [0]	
Bit 3	Not used [0]	
Bit 4	Not used [0]	
Bit 5	Not used [0]	
Bit 6	Not used [0]	
Bit 7	Not used [0]	Status 2
Bit 8	Digital input 3	
Bit 9	Digital input 4	
Bit 10	Digital input 5	
Bit 11	Digital input 6	
Bit 12	Digital input 7	
Bit 13	Digital input 8	
Bit 14	Low Battery input	
Bit 15	RTU Restarted	

Table 1; Status1 and Status2

Installation in NetTroll

The ComTroll 330 ICU can be installed in NetTroll version 3.6.7 or later. By default the GSM feature is disabled. To activate NetTroll for installation of GSM devices, select *View | Options* from the main menu. In the *General* tab, the item 'Disable GSM' must be de-selected.



The GSM LON Router.

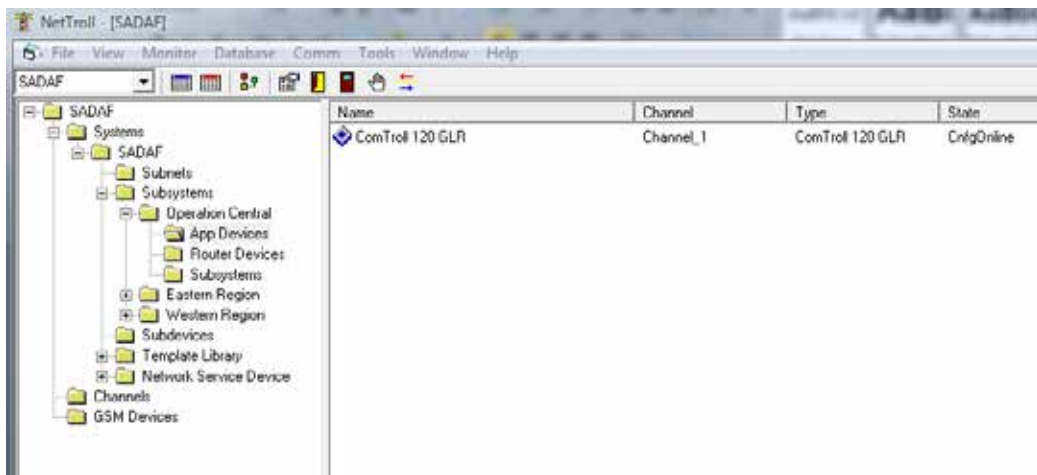
The ComTroll 120 GLR must be installed before any ComTroll field Device such as ComTroll 333 ICU can be added into the NetTroll Database. This unit is installed in the same way as

other devices using the LonWorks technology, e.g. ComTroll 155 RTU with radio communication.

Detailed information about the ComTroll 120 GLR and installation of the device can be found in the user manual for ComTroll 120 GLR.

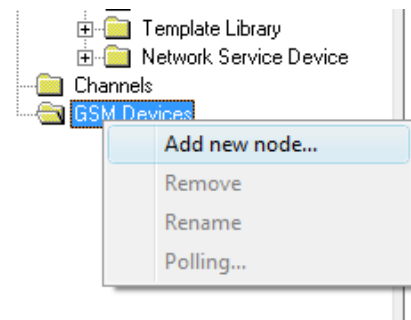
It is important to notice that the ComTroll 120 GLR is installed in a Subsystem as an AppDevice and will not appear under the GSM Devices catalogue.

All ComTroll GSM field devices are installed in the same Subsystem, called "GSM Devices". The procedure for creating new networks and subsystems in NetTroll can be found in the NetTroll User Manual.



Creating an image of ComTroll 333 ICU in the database

Right-click the 'GSM Devices' folder and the following menu appears:



Select *Add new node*.

- NodeID: Type an increasing number for each device installed.
- Name: The Name the field device will get. This name will appear in all logs and in the SMS message send by NetAlert (optional)
- Description: Do not type any information here.
- Device Type: This links the device to a specific set of messages and control window.
- Phone No: Type the phone-number for the SIM card inserted in the device.
- Password: Type the password given to the device.
- GLR Name: Select the GLR device this ComTroll 333 ICU should communicate with. Several GLR devices can be installed in the same network.
- Settings: N/A

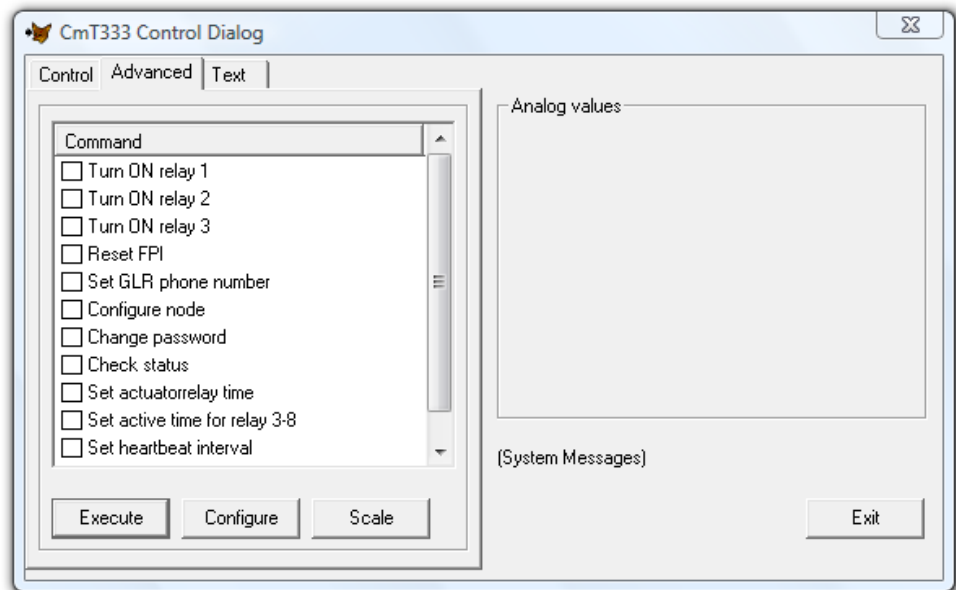
Please note that no SMS messages are exchanged between the devices during this registration.

Setting the Device Properties.

Please note that before any changes to the configuration described below is stored in the database, NetTroll must receive an acknowledgement on each setting. Please therefore check the NetTroll event log for incoming acknowledge on the last sent setting before any new settings are sent.

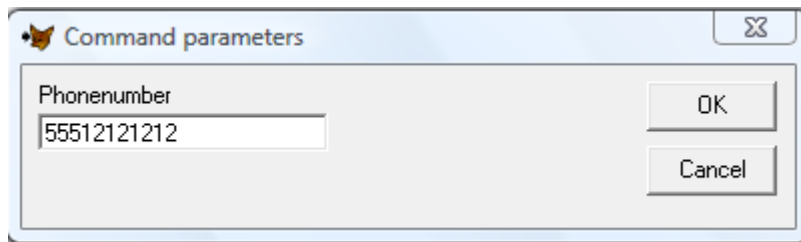
Select the device name for the ComTroll 333 ICU you are about to configure. (Double-click on the device name).
Enter the *Advanced* Tab.

Name	Node ID	Telefon	Type
F_North_Pole 2344	1	555899889	ComTroll 333 4Al

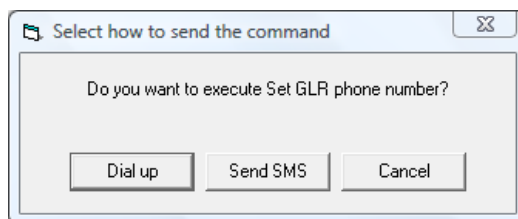


Execute the configuration in the following order:

1: Set GLR Phone Number:

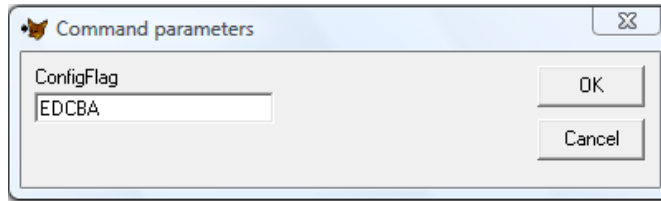


Type the telephone number for the ComTroll 120 GLR device. After pressing the OK button you may be asked for type of connection (varies upon NetTroll version).



Always select SMS when sending to the ComTroll 333 ICU.

2: Configure device:



Note! All 5 characters must be typed.

The meaning of each character as follows:

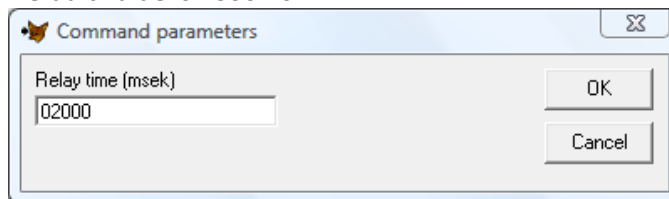
E	D	C	B	A	Meaning
x	x	1	1	0	Sends alarms on changes from Non-active to Active Di_1 to Di_6
X	X	1	1	1	Sends alarms both on changes from Non-active to Active and from Active to Non-active Di_1 to Di_6
X	X	1	1	X	Always set B to '1' in CmT333 ICU
X	X	1	1	X	Always set C to '1' in CmT333 ICU
X	0	1	1	X	Use 2 analog inputs
X	1	1	1	X	Use 4 analog inputs

3: Set relay timeout relay 1 to 4:

The time can be set in milliseconds in the range from 200 ms to 64000 ms.

5 numbers must be typed, as in the example below, where relay timeout on relay 1 to 4 is set to 2000ms.

Default value is 1000ms.



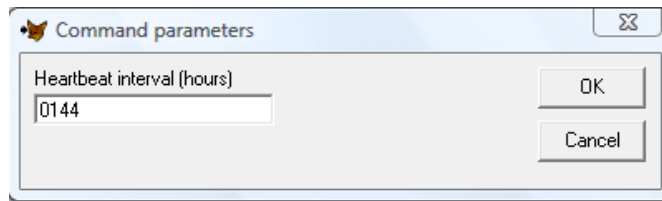
4: Set Heartbeat Interval

Each ComTroll 330 ICU will send a heartbeat message within a specified time interval.

If NetTroll is missing TWO heartbeat messages in a row, an alarm will be raised.

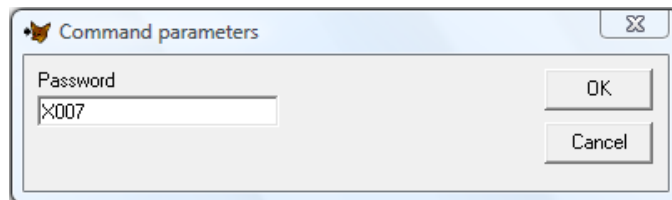
The heartbeat can be switched OFF by setting 0000 hours. 4 characters must always be sent.

The example below gives a heartbeat message every 6th 24-hour period. (144 hours). Default heartbeat is 72hours.



5: Change password:

The default password should be changed to a user defined password before installing it in a live system. The password must be exactly 4 characters long. Both numbers and letters (case sensitive) can be used.

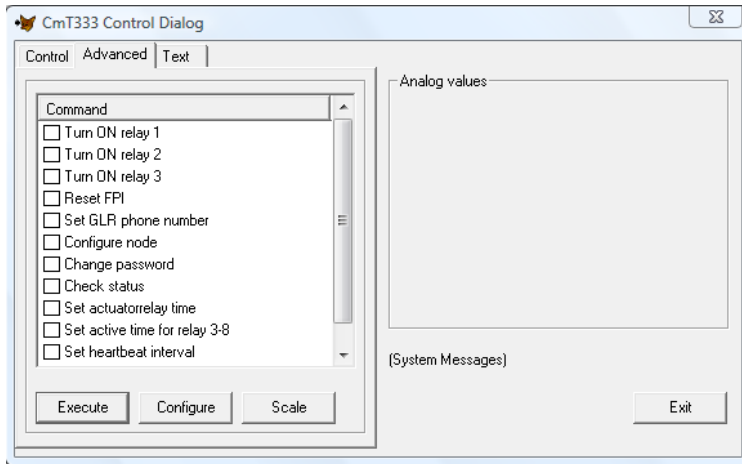


Setting the analog input properties in NetTroll.

All four analog inputs can be set up to accommodate 0-10V or 4-20mA individually. See figure 2 for details regarding the DIP switch settings. All inputs have a 10-bits resolution. The raw value can be in the range between 0 and 1024.

The ComTroll 333 ICU always sends raw values. The raw value must be converted into a unit matching the measured value in NetTroll. The way the analog input properties are set up may vary upon the NetTroll version. Please refer to the NetTroll manual for details. The below description is based on NetTroll 4.0.

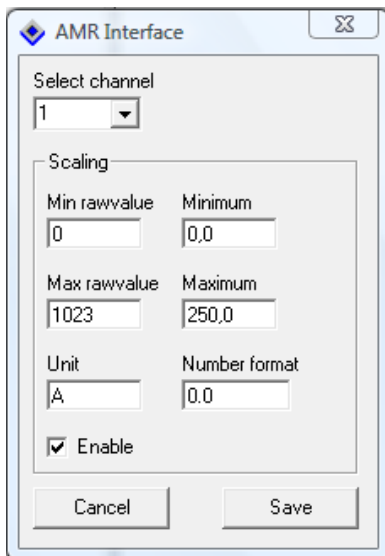
Select the device name for the ComTroll 333 ICU you are about to configure. (Double-click on the device name).
Enter the *Advanced* Tab.



Press the 'Scale' button.

Example1

Setting analog input 1 to read a 0 – 10 V signal from the secondary side of a transducer, measuring load current between 0 – 250 A on the primary side. Please note that the DipSwitch nr 1 and 2 must both be set to OFF. See figure 2.



Select Channel:

Select the analog input number to configure, in this case '1'.

Min rawvalue:

Set to '0' as the minimum measured voltage is 0V.

Minimum:

The value that appears in NetTroll when the transducer gives 0V on the secondary side.

Max rawvalue:

Set to '1023' as this is the raw value sent when the voltage applied on the analog input 1 is 10Vdc.

Maximum:

When the transducer measure 250A on the primary side, the output will be 10Vdc, equals 1023 in raw value. Type 250.

Unit:

The unit will be added as a text behind the value reported in NetTroll.

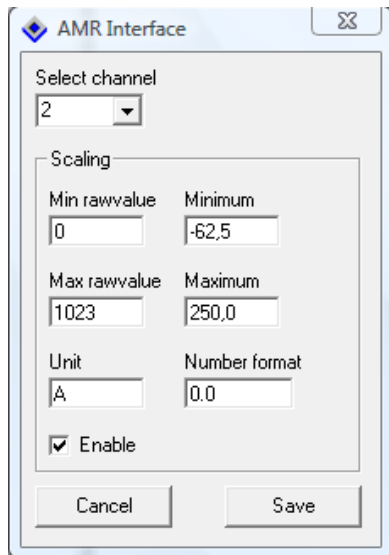
Number format:

Defines the number of decimals to be used in the measurement.

Example 2

Setting analog input 2 to read a 4 – 20mA signal from the secondary side of a transducer, measuring load current between 0 – 250 A on the primary side. Please note that the DipSwitch nr 3 and 4 must both be set to ON. See figure 2.

0A = 4mA and 250A = 20mA. This means that a negative minimum value must be set in the scale setting. $(250/16)*4=62,5$. As the displayed value when the transducer gives 4mA should be 0A, the displayed value then the transducer gives 0mA should be a negative value, indication that something is wrong. (broken current loop etc).



The screenshot shows the 'AMR Interface' window with the following settings:

- Select channel: 2
- Scaling:
 - Min rawvalue: 0
 - Minimum: -62,5
 - Max rawvalue: 1023
 - Maximum: 250,0
- Unit: A
- Number format: 0,0
- Enable
- Buttons: Cancel, Save

Select Channel:

Select the analog input number to configure, in this case '2'.

Min rawvalue:

Set to '0' as the minimum measured raw value when the transducer gives 0mA.

Minimum:

The value that appears in NetTroll when the transducer gives 0mA on the secondary side.

Max rawvalue:

Set to '1023' as this is the raw value sent when the current applied to analog input 2 is 20mA.

Maximum:

When the transducer measure 250A on the primary side, the output will be 20mA, equals 1023 in raw value. Type 250.

Unit:

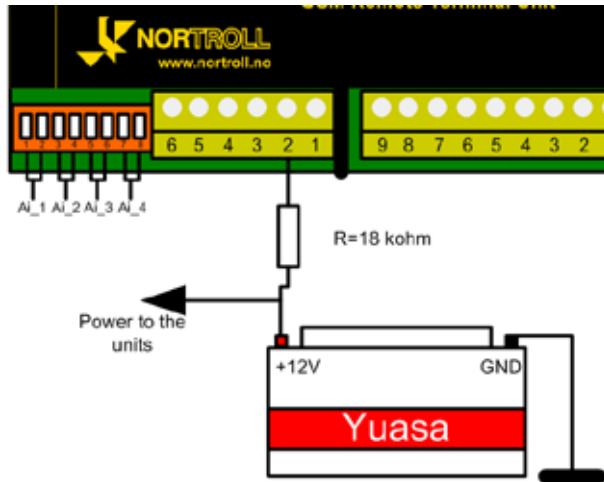
The unit will be added as a text behind the value reported in NetTroll.

Number format:

Defines the number of decimals to be used in the measurement.

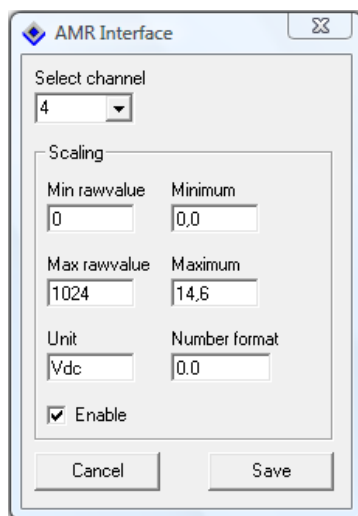
Useful tip: Monitor the battery voltage with one of the four analog inputs.

On some of the ComTroll RTU devices, one of the analog inputs is dedicated for reading the battery voltage. It is not the case in the ComTroll 333 ICU, but still it is possible. To change the measurement range from 0 – 10 Vdc to 0 – 14,6Vdc, an external resistor must be inserted as shown below.



In the above picture, the measurement is done on analog Input 4. This means dip-switch 7 and 8 must both be OFF.

The scaling for analog input 4 in NetTroll must be set as follows:



4. Technical Specifications

Application:	Remote Terminal Unit with GSM communication.
GSM Module:	Wavecom Q64 Quad band
Inputs:	8 general optic isolated digital inputs. (Max input voltage: 50Vdc). 4 analog inputs (0-10V or 4-20mA).
Outputs	4 user specified Normally Open relays. Maximum switching: 200V/1A (AC/DC)
Power supply:	Min: 10Vdc Max: 15Vdc
Power Consumption:	8mA in idle. 80mA when connected to the GSM Network. This will vary upon signal strength.
Type test:	IEC 61000-4-2 ESD Immunity test IEC 61000-4-4 Fast transient / Burst Immunity test IEC 61000-4-5 Surge Immunity test ROHS compliant
Mounting:	Snap-on DIN-rail
Temperature range:	-25 to + 70 deg Centigrade operational.
Dimension:	160 x 90 x 80 mm
Weight:	315g

Ordering Information

Product nr: 02-0330-03 ComTroll 333 ICU

Related products:

Product nr: 7652	ComTroll 120 GLR Router
Product nr: 15-7540-01	NetTroll 4 MicroSCADA Software
Product nr: 15-7500-02	NetAlert 3.0 SMS-Alarm Module w/ GSM modem
Product nr: 15-7500-40	NetTroll SCADA Gateway
Product nr: 02-0330-19	External GSM antenna including bracket and cable

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