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1. Introduction

1.1. General

The Concentrator is a part of **AMI** (Advanced Metering Infrastructure) system. The concentrator performs communication between AMI master station (control center) and electricity meters.

The concentrator is a central unit for remote reading, processing and controlling electricity meters that communicates with the meters over the low voltage power network, using two way PLC (Power Line Communication).

The concentrator communicates with the control center over the cellular network - **GSM/GPRS**.

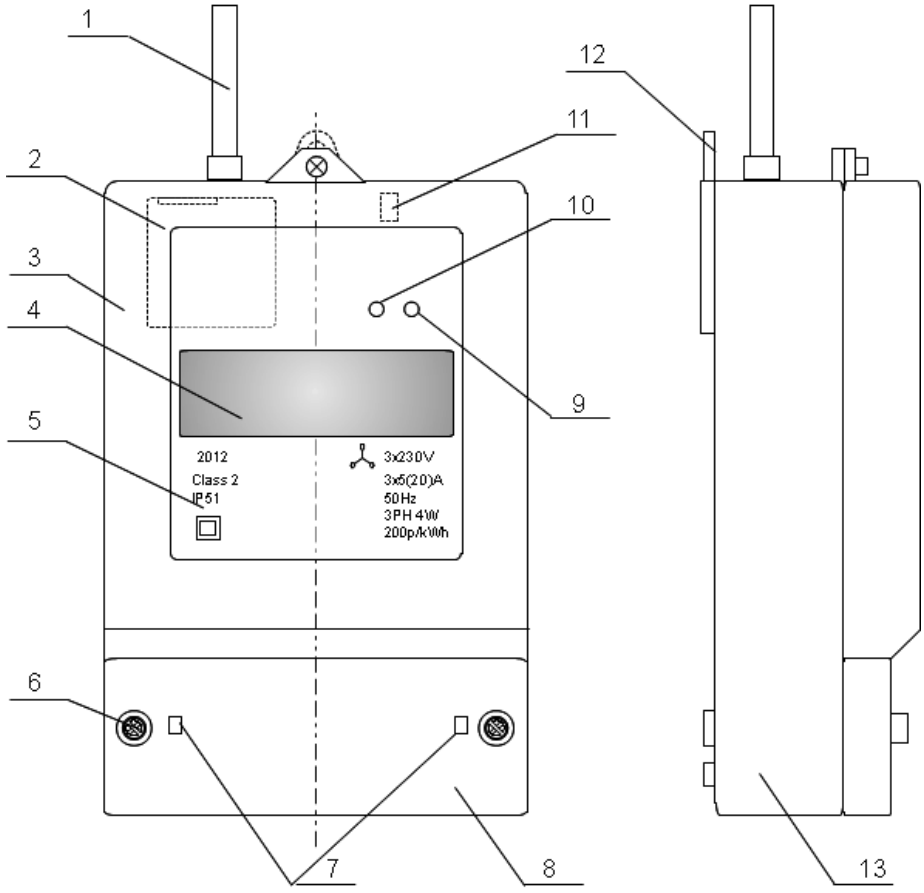
Complete reports are transferred periodically from the **concentrator** to the control center, directly via the cellular network -**GSM/GPRS**.

The concentrator can also operate as a three phase meter for measurement of the substation voltage, output power and accumulated energy consumed.

Fig. 1.1 General view of concentrator.

2. Product information

2.1. Concentrator parts



1	GSM Antenna	8	Terminal cover
2	GSM Modem (under Upper cover)	9	IrDA port
3	Upper cover	10	Red LED – Power
4	LCD display (protected by transparent window)	11	Red LED – GSM
5	Label	12	Hanger
6	Terminal cover's screw and sealing point	13	Lower part of case
7	Sealing points		

Fig. 2.1 Concentrator front/side view

2.2. Technical Data

General	
Nominal Voltage (Un)	3 x 230V AC
Supply Voltage range	80% - 115% Un
Nominal Frequency (fn)	50Hz
Consumption at Un	5 W – 4.1 Var (Capacitive)
System connections	3 phase 4 wire
Measurement	
Class Index	
Active energy acc. to IEC62053-21	Class 2
Reactive energy acc. to IEC62053-23	Class 2
Basic Current (Ib)	3x5A
Maximum continuous current (Imax)	3x20A
Environmental	
Temperature range	
operation	-10ºC to 55ºC
storage	-25ºC to 70ºC
Insulation Strength	
Protective Class acc. to IEC62052-11	Class I I
Display	
Type	LCD
Format	16 Characters x 2 Lines
Character size	9.55mm x 5.2mm
LED Indicator	
Flash rate	200 imp/kWh
Communication Interfaces	
Cellular	Quad-band GSM 850/900/1800/1900MHz
PLC Frequency range	A-band 60-90 kHz
PLC Method	Spread FSK
Optical Comm. port **IrDA** baud rate	9600bps

Weight and Dimensions/ Case protection	
Weight	1300 g
Width	145 mm
Height	228 mm
Depth	74 mm
Enclosure protection according IEC60529	IP51

Phase connections	
Connection system type	Screw type terminals
Diameter	6 mm
Maximum conductor cross-section	6 mm²
Minimum conductor cross-section	4 mm²
Screw dimension	M4x8
Screw head	Slotted,/comb. drive
Max. screw head diameter	< 6.8 mm
Tightening torque	<1.5 Nm
Voltage circuit connections	
Connection system type	Screw type terminals
Diameter	4.5 mm
Maximum conductor cross-section	1.5 mm²

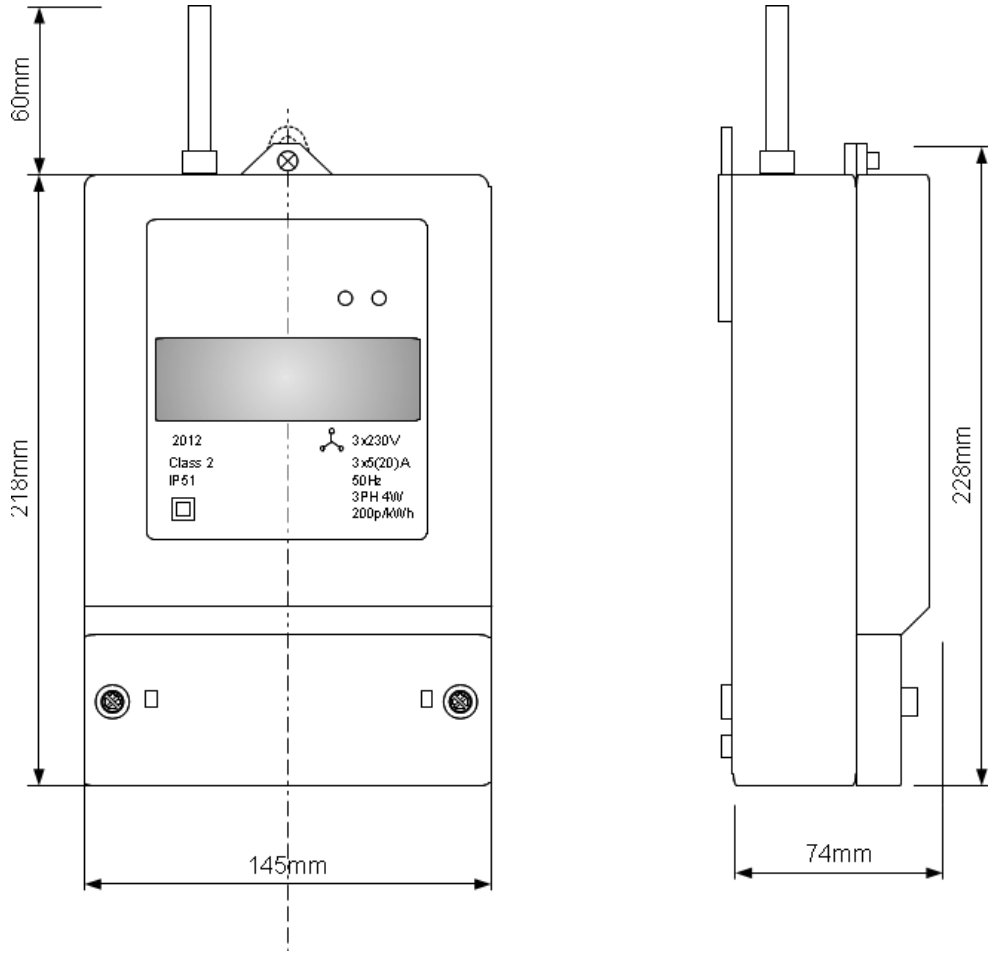


Fig.2.2 Concentrator Dimensions

3. Safety regulations

The following safety regulations must be observed at all times:

- When installing or opening the concentrator the connections must be free of voltage. Touching parts under voltage is life threatening. The relevant feeding breakers should therefore be turned OFF until the work is completed.
- Local safety regulations must be observed.
- Installation of the concentrator must be performed by qualified industrial electricians only.
- Concentrators which have fallen must not be installed, even if no damage is apparent, but must be returned for testing to the service or the manufacturer. Internal damage can result in functional disorders or short circuits.
- The concentrator must on no account be cleaned with water or with high pressure devices.

4. Installation and initialization

The installation must only be performed by qualified industrial electricians!

The electricians installing the concentrator must be familiar with and strictly follow the local safety regulations and safety regulations specified in this "Installation manual".
The installer is responsible that the concentrator is correctly and safely installed.

4.1. Components required

4.1.1. The concentrator has an internal GSM modem.
A local SIM card for the concentrator modem should be prepared in advance, and activated.
The SIM card should be enabled to the following function:

- Send and receive SMS;
- Receive voice calls;
- Support static or dynamic IP address for access to the Internet through the GPRS connection. Static IP address must be used in case there is a need for direct access from the control center.

4.1.2. Define the phone number which will be used to control the concentrator by sending SMS.

4.2. Mounting the concentrator

WARNING! The connecting wires at the place of installation must **not** be live when mounting the concentrator. Touching live parts is life threatening. The feeding breakers should therefore be turned OFF until work is completed.

The concentrator should be mounted on an open board or inside a case provided for this purpose. The concentrator has one hanger on the top backside and two mounting holes in the terminal block, see Fig 4.2.

1. The concentrator installation place should have good GSM coverage and should be as close as possible to the low voltage substation
An external GSM antenna should be attached to the SMA connector on the top of concentrator case, *Fig.2.1 positions 1*.

In order to mount the concentrator correctly, the following requirements for antenna placement should take into account:

- The GSM antenna must **not** be placed inside metal case

The antenna must be installed providing a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

2.The active SIM card has to be inserted into the modem. In order to insert SIM card :

- Unscrew and remove Terminal cover and then remove Upper cover. Fig.2.1 positions 3,8
- Insert the local SIM card into the modem, *Fig.4.1*
- Close Upper cover and tighten it by three screws.

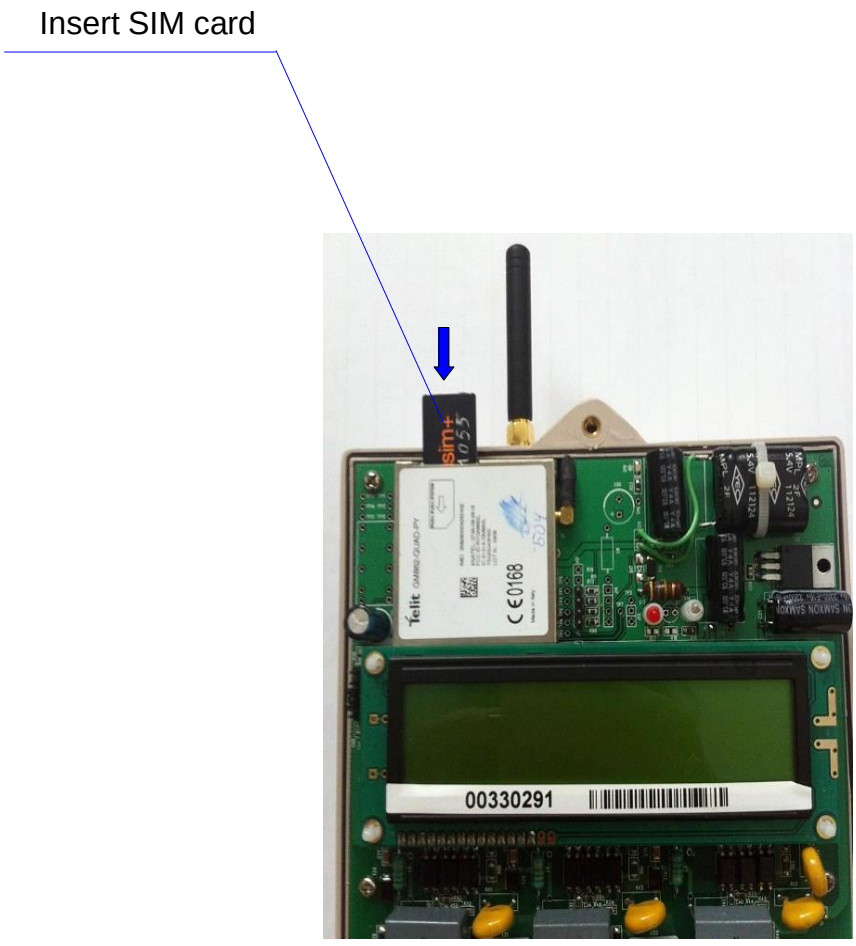


Fig.4.1 Concentrator view without covers

3. Set the concentrator hanger in the desired position and fix it by screw .The hanger on the case backside can be moved up and down as shown on *Fig 4.2.*

4. Turn power OFF. Make sure voltage is zero. Check with a phase tester or universal measuring instrument whether the connecting wires are live.

5. Make the three holes for the mounting screws on the surface where the concentrator has to be installed. The mounting dimensions are according to *Fig 4.3.*

6. Fit the concentrator, using the three mounting screws, on to the mounting board :

1. First fasten the upper screw;
2. By using two screws fasten the concentrator through the bottom holes in the concentrator terminal block to the mounting board.

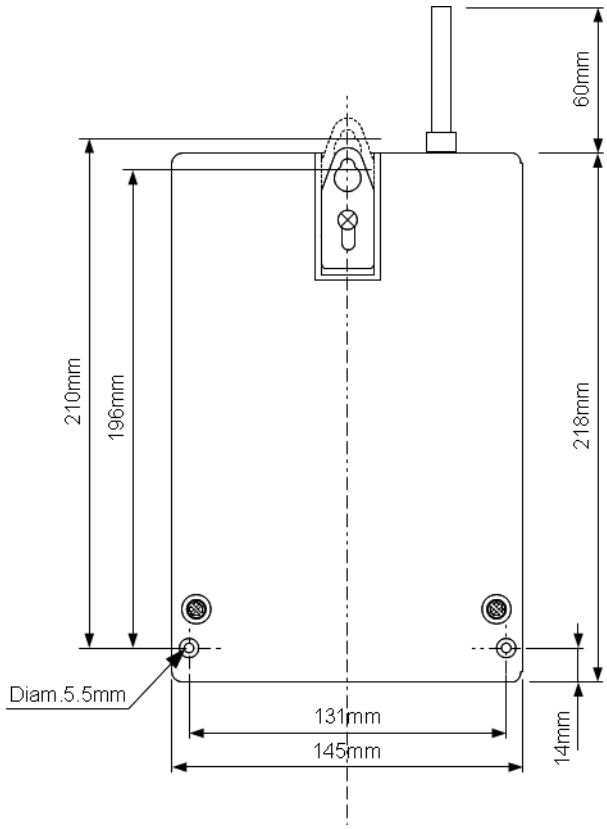


Fig.4.2 Concentrator Backside view

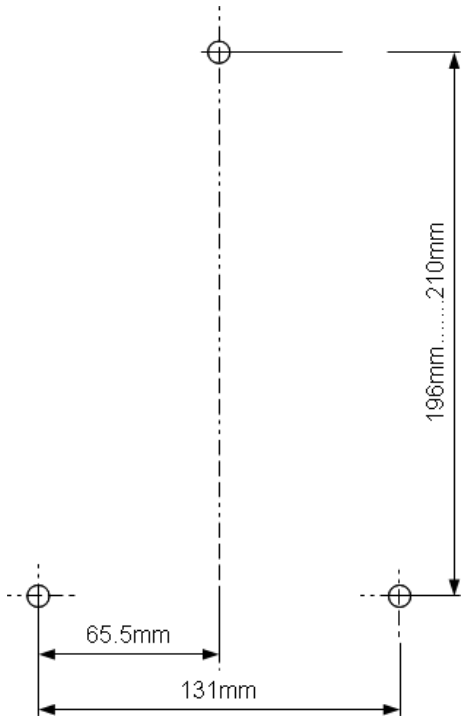


Fig.4.3. Drilling plan

4.3. Connecting the concentrator

WARNING! The connecting wires at the place of installation must **not** be live when fitting the concentrator. Touching live parts is life threatening. The feeding breakers should therefore be turned OFF until work is completed.

1. Turn OFF power. Make sure voltage is zero. Check with a phase tester or universal measuring instrument whether the connecting wires are live.

2. Remove the terminal cover in order to get easy access to terminal connections.

3. Shorten connecting wires to the required length and then strip them. If stranded wire is used, it must be provided with wire terminal for connection.

4. Connect the wires according to the diagram on the terminal cover and according to installation diagram in this guide, see *Fig. 4.4* .Tighten the terminal screws firmly.

5. Make sure that the screws are tightened properly and the wires are not loose.

6. Check that the concentrator is correctly wired and connected to the specified voltage 3x230(400)V. Verify that the inputs and outputs of each phase are connected correctly. Make sure each phase is connected to a phase and neutral to the neutral according to connection diagram on the terminal cover.

7. Check that the input terminals are connected to a source of power after circuit- breaker with rated switching current less than max current of the concentrator in order to provide circuit protection.

8. Attach GSM antenna to the SMA connector on the top of the case, *Fig.2.1, position1*. Insert the base of the antenna into connector and tighten it clockwise.

9. Close the terminal block with terminal cover and fasten it by two screws. Seal with two seals in order to prevent non-authorized access.

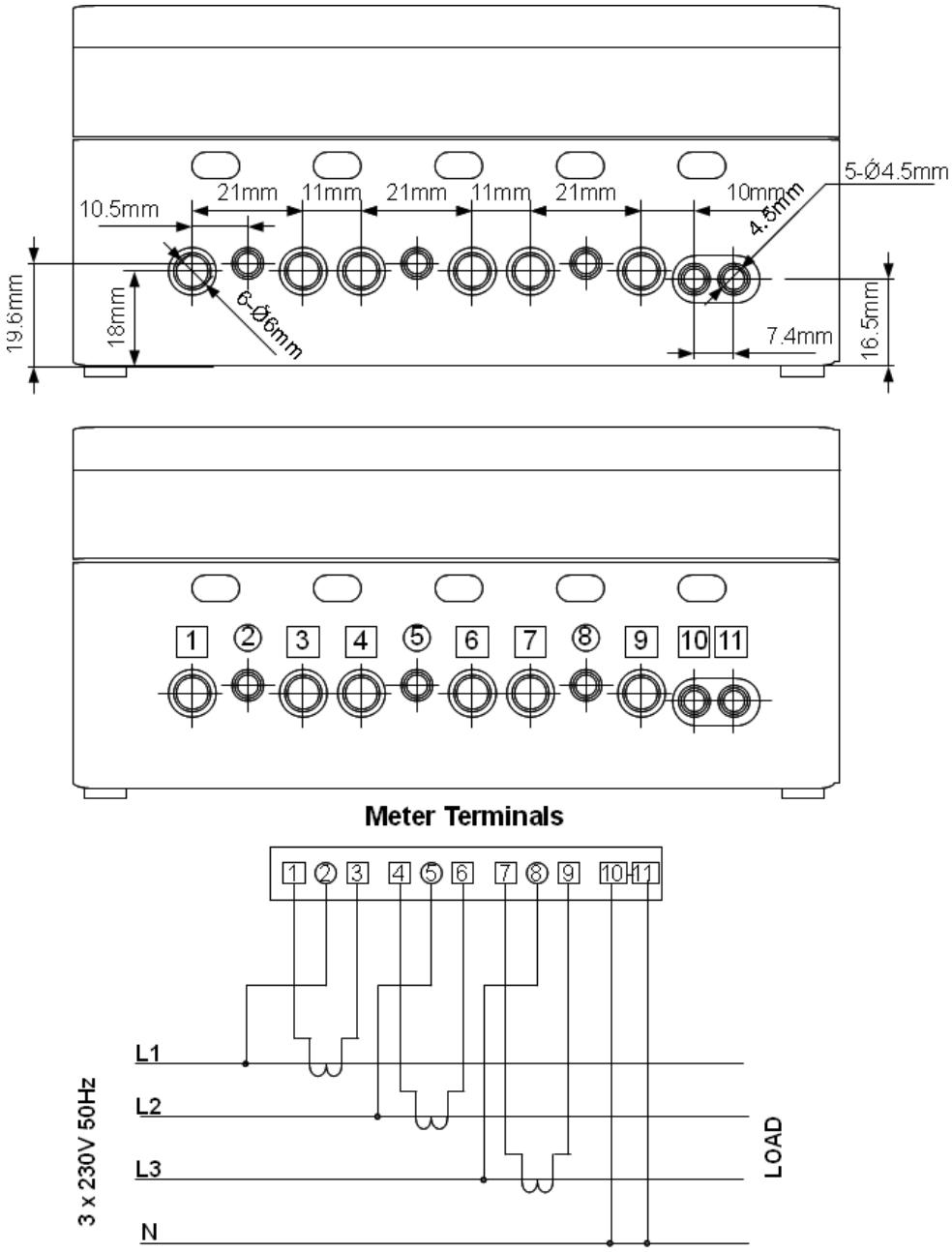


Fig. 4.4. Terminal dimensions and connection diagram

4.4. Concentrator initialization

All concentrator functions and SMS/IP commands are described in the "Concentrator Functions" document.

The concentrator is supplied from the manufacturer with manufacturer's control cell number, GPRS setting and program.

The following steps are required for concentrator initialization:

- Set the Control Number;
- Set APN (GPRS) of local service provider;
- Set source email address with its SMTP and POP3 server addresses.
- Update concentrator program if needed.
- Add one or more E-mail destinations;

Initialization Process:

1. Turn power ON.

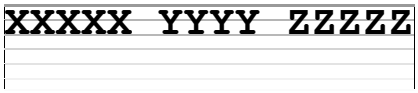
WARNING! Leaving the terminal covers open may cause a risk of touching the electrified terminals which is life threatening.

2. Make sure the concentrator is active and displays information. After 10 -15 sec:

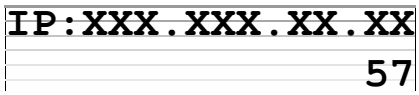
- The red "LED–Power" is ON or pulsing;
- The red "LED-GSM" is pulsing.
- LCD displays scrolling messages every 2 second.

1. **The red "LED–Power" *(Fig.2.1, position 10)* indicates power consumption. While the concentrator is on, its red light is visible and blinks at a rate depending on the power passing through the concentrator relative to the pulse rate indicated on the label.**
2. **The red "LED-GSM" *(Fig. 2.1, position11)*, placed below the transparent cover, shows if network service is available. Fast LED blinking (about 1 pulse per sec) indicates the modem is searching the network and is not registered yet. Slow LED blinking (1 pulse per 3 sec.) indicates the modem is registered and has for service.**

3. Wait until LCD Display stops scrolling initial messages and shows permanently one of the following information:



This message indicates that the APN setting is wrong and must be set.



This message indicates there is no application program in the concentrator and it must be downloaded.

4. Set the Control Number.

- get from Unique Technology Ltd. the present concentrator control cell number;
- According to command "Control Number" described in "Concentrator Functions" document, send SMS with present control cell number to concentrator modem. Start control cell number with "+" and end the SMS with CRLF.

The phone number sending this command will be the new Control number.

You should receive SMS "Change Number", this message will also appear on the concentrator display.

5. Set GPRS.

APN setting allows the modem to connect to Internet using GPRS network. Send SMS from the control number according to command "GPRS setting" in "Concentrator Functions" document. End the SMS with CRLF.

Check that you receive the response "New APN" to your phone and see this message on the concentrator display.

6. Update concentrator program, if required.

Send an SMS according to the "Download File" function described in "Concentrator function" document. This command will initialize an application program file download from the server. For information about available programs you should contact Unique Technology LTD.

Concentrator performs software download (you can see indication of this process on the display) and thereafter a reset. Concentrator sends back SMS that contains data, for example:

IP: XX.XXX.XX.XX	- IP address;
Power	- Reason (for example after power will restored);
No. 00003594	- Concentrator serial number;
Py005@20/06/12	- BIOS name and version;
colAMR.pyo rev:0078	- Application software name and version

The command "Download File" is used to update TOU table and other updates.

7. Update the E-mail destination address according to the "Email destination" command described in "Concentrator Functions" document. It is possible to set multiple addresses.

8. The concentrator is ready to work and execute commands described in "Concentrator functions" document.

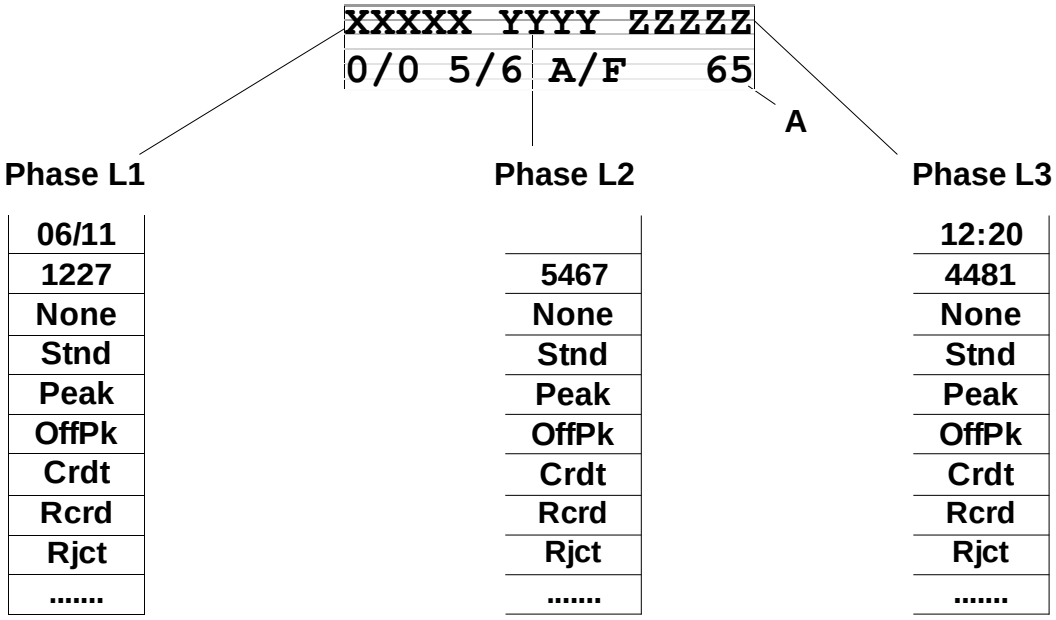
Note: All SMS messages sent from control number to the concentrator should end with CRLF.

The LCD scrolls messages according to the application program. For an example of LCD message list see *Fig.4.5*.

The top line of the LCD screen is divided into 3 zones according to phase L1, L2, L3. Each zone shows data of a different phase, each zone scrolls independently. Date and Time are shown on phase L1 zone and phase L3 zone respectively.

The bottom line includes technical information related to PLC communication on each phase.

The level of GSM signal in % is displayed in the lower right corner (zone A). The level of GSM signal should be greater than 50%.



06/11 or 12:20	Date DD/MM or Time HH:mm synchronized from nist.time.gov site
1227	Last 4 digits of meter serial number, currently communicating with concentrator over PLC in appropriate
None	No remote unit communication detected
Sntd	Standard tariff currently
Peak	active Peak tariff currently
OffPk	active Off Peak tariff
Crdt	Credit meter received
Prep	Prepayment meter
Rcrd	Load curve recording
Rjct	received Unknown data

Fig. 4.5. Examples of concentrator display screens

5. Maintenance instructions

The following points should be checked on the concentrator periodically:

- The concentrator is in operation and serviceable.
- All seals are undamaged
- The condition of plastic around the terminals is undamaged
- Wire isolation is undamaged
- The concentrator is dry.
- The plastic covers are clean and transparent

If the concentrator transparent window is dirty and needs to be cleaned, use damp cleaning cloth to remove the dirt.

WARNING! Make sure no liquid enters into the concentrator as this could damage the concentrator.

If the concentrator does not operate correctly, the concentrator should be disconnected, removed and sent to the responsible service and repair center.

6. Disconnecting concentrator

The concentrator should be removed as follows:

1. Turn power OFF.
2. Remove the two seals, unscrew plastic terminal cover and open it.
3. Make sure that the concentrator terminals are not live using a phase tester or universal measuring instrument.
3. Release the terminal screws of the connecting wires with a suitable screwdriver and pull out the connecting wires from the terminals.
4. Release the three mounting screws and remove the concentrator.
5. Fit a replacement concentrator as described in Section 4 “Installation”.

The protection provided by the equipment may be impaired if the product is used in a manner not specified in the Manual.