Telem SCADASystem

Software installation and database filling

Software Manual

MARTEM
TELECONTROL SYSTEMS

1 CONTENTS

1 TELEM SCADA SYSTEM INSTALLATION

Depending on the system setup type, Telem SCADA (just 'SCADA' from now on) can be installed on various operating systems. Typically standalone Telem Data Concentrator (just 'TDC' from now on) is installed on Microsoft Windows NT 4.0, but can be installed on newer NT based Microsoft Windows operating systems also. Telem SCADA Server (just 'Server' from now on) or Servers, if configured for hot standby, are installed typically on Windows XP. Workstation machines (just 'Client machines' from now on) also use Windows XP. If TDC is included in Server machine or all of the software is installed on one machine, typically Windows XP is chosen.

1.1 SCADA SERVER SOFTWARE INSTALLATION

1.1.1 RECOMMENDED PARTITIONING

C: For TDC configuration database files and primary operating system. Size at least 10GB.

D: For backup operating system. Size at least 5 GB.

E: For Telem SCADA system. Size at least 30 GB.

1.1.2 COMPONENT INSTALLATION

To install the SCADA system, run the installers in the order as told below from the supplemented Telem Software CD and follow the instructions. This will install all the catalogs and files needed. Example configuration files are installed also.

How to configure the system to your needs is described later in this document.

1) Install 4 MySql components:

- MySql Essentials --- MySql Server.
- MySql Administrator --- tool for configuring databases and performing backups.
- MySql Query Browser --- tool for editing databases.
- MySql ODBC Connector --- MySql - ODBC Bridge.

MySql Server configuring parameters:

- If the machine has more than 512mb of RAM, select machine type as server machine
- In the database type section choose "non-transactional database"
- In the language section select "Best support for multilingualism"

- Set the root password to "pass" for easier remembering

2) Start MySql administrator and create a new connection with this data:
   - Name can be anything
   - Server must be localhost or 127.0.0.1
   - Username and pass should be "root" and "pass"
3) From MySql Administrator start restoring the database template given and check the box that says: "Create database(s) if they don't exist" and then hit ‘start restore’.
4) From MySql administrator create a new user
   - Username must be "sysdba"
   - Password must be "pass"
   - Under the schema privileges tab for this user, give him "select, insert, delete and update" rights for ‘tlm_server’ database
5) Install Borland Database Engine (BDE) and overwrite the original idapi32.cfg with the one from the install media.
6) Install DesKey drivers using the dk3win.exe executable.
7) Install SCADA Server into 3'rd partition on the machine (E:)
8) Install SCADA Server TDC Database into C: drive of the Server Machine
9) Recheck server configuration files if they need additional changing and restart the machine.

If you installed SCADA systems to a different partitions then told here then don’t forget to modify the catalog references in configuration files.

1.2 SCADA TDC SOFTWARE INSTALLATION

TDC can be installed depending on configuration on to Windows NT4.0 or Windows XP. There are no specific recommendations for TDC partitions. Typically TDC is installed into to the root directory under the Telem directory.

To install the initial files and directory structure please run “TDCinstall.exe” from the supplemented Telem Software CD. This will install all the catalogs and files needed. Example configuration files are installed also. Install Borland Database Engine (BDE) and overwrite the original idapi32.cfg with the one from the install media.

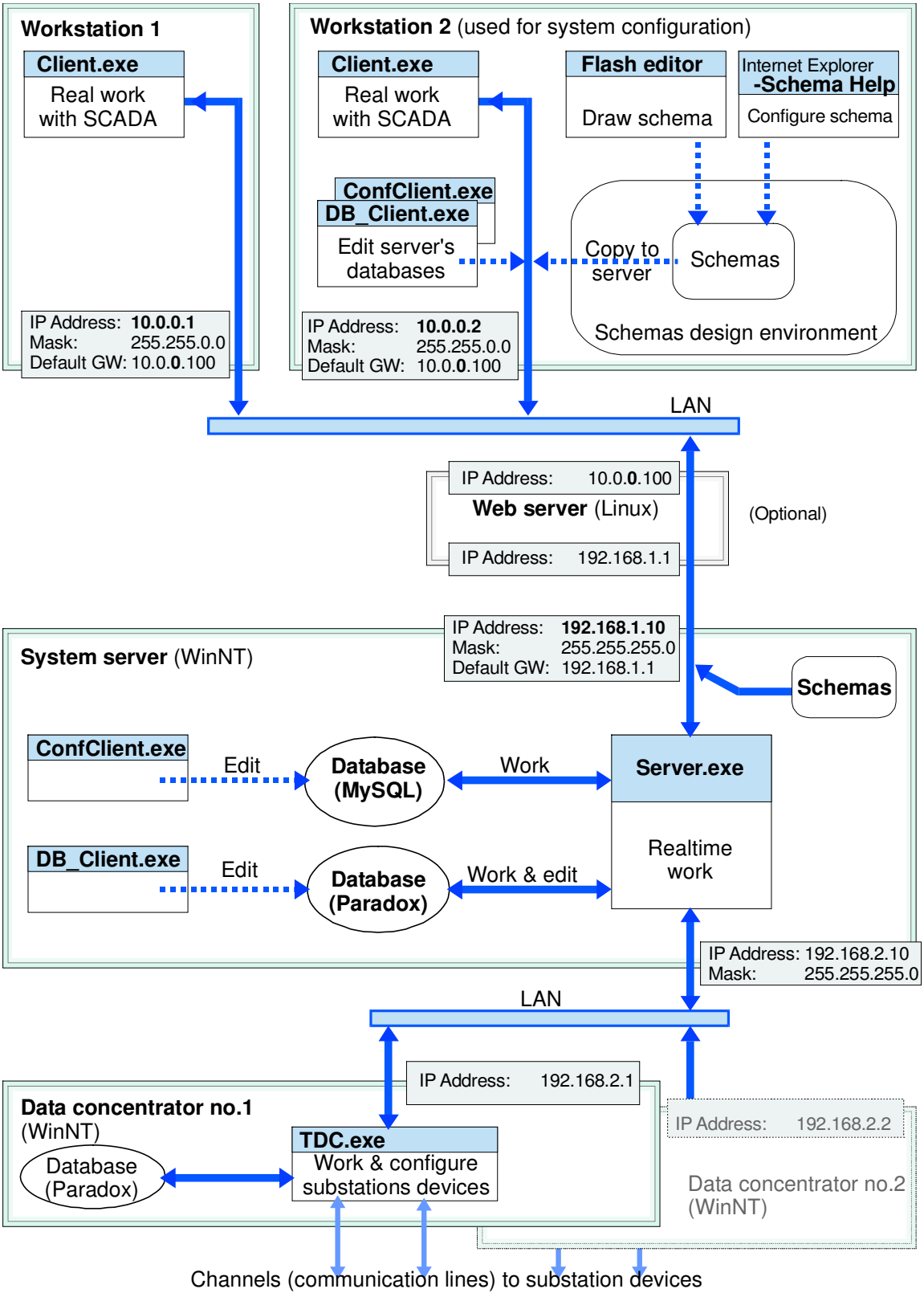
How to configure the concentrator to your needs is described in the document “Database concentrator”

1.3 SCADA CLIENT SOFTWARE INSTALLATION

Like for the TDC there is no specific requirements form partitions. Any 32-bit Microsoft Windows operating system should work fine.

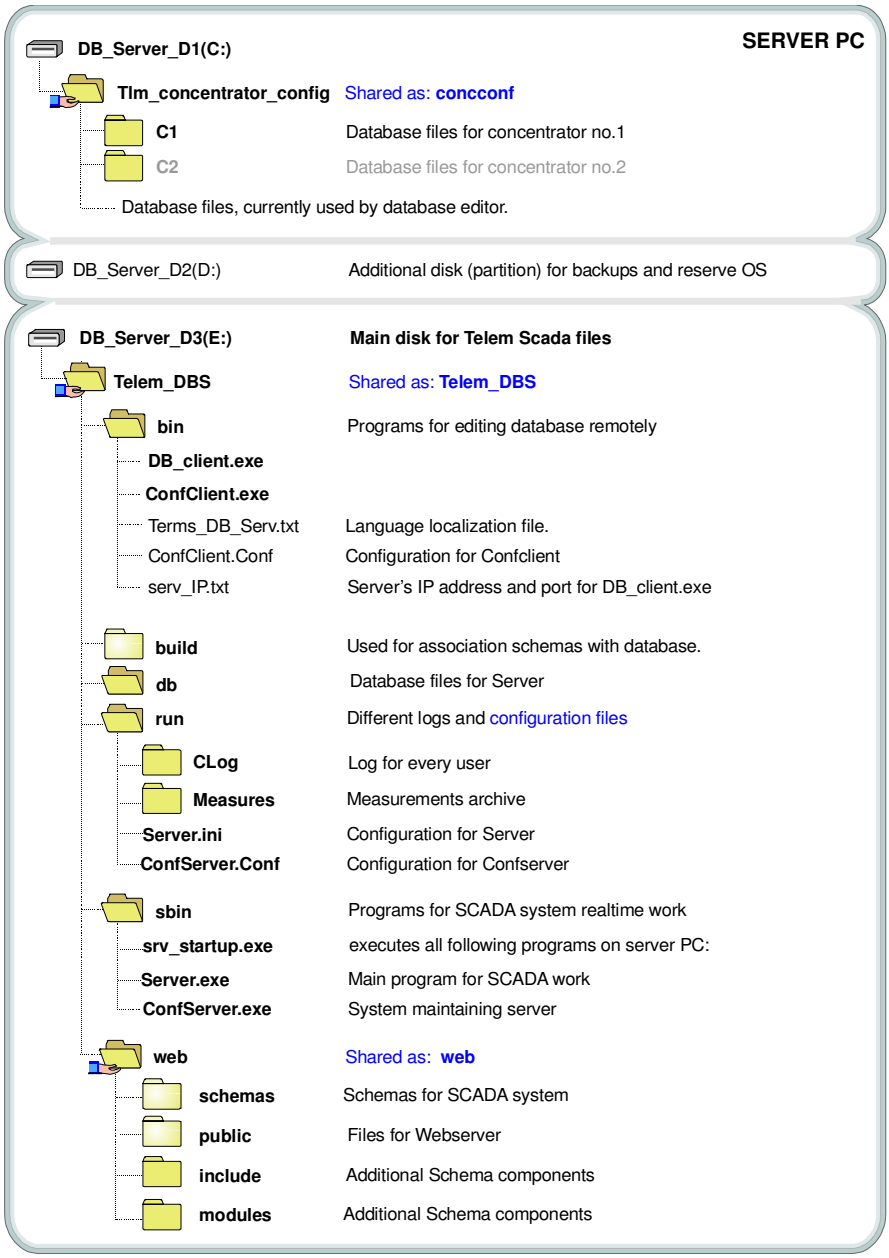
To install the initial file structure, please run “SCADA client install.exe” from the supplemented Telem Software CD. This will install all the catalogs needed. Example configuration files are installed. Macromedia Flash player has to be installed also. The installers for Flash can be found in the Telem SCADA Client installation directory.

1.4 General system structure and example TCP/IP settings

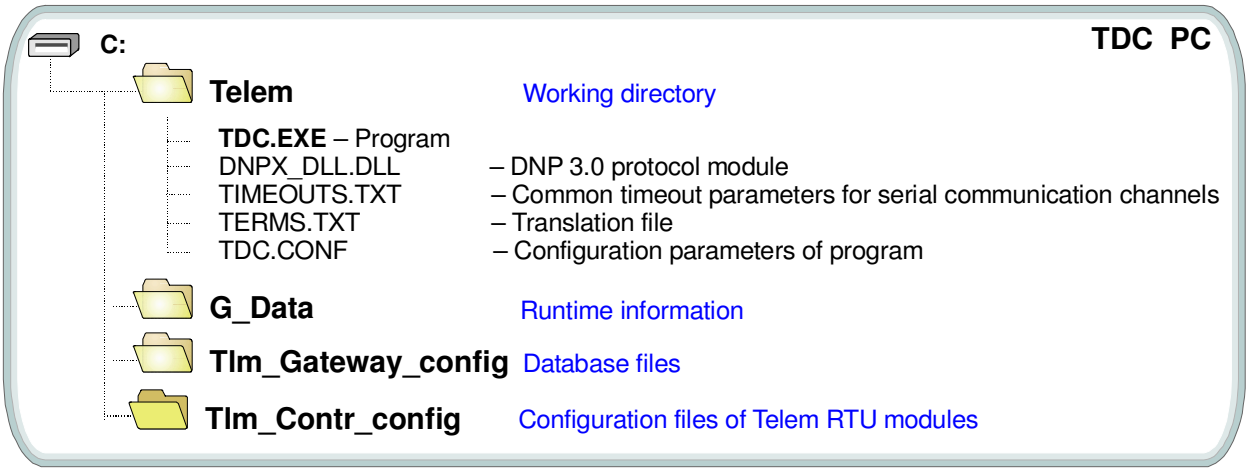


2 TYPICAL DIRECTORY STRUCTURES

2.1 SERVER DIRECTORY STRUCTURE

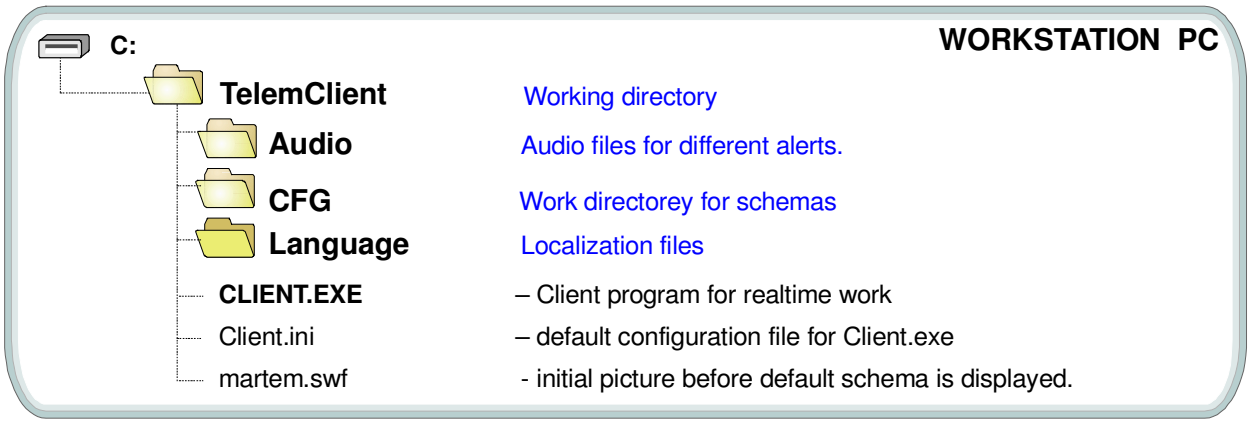


2.2 TDC DIRECTORY STRUCTURE



For further information about TDC configuration please read from the section 6: "Telem Data Concentrator".

2.3 CLIENT DIRECTORY STRUCTURE



3 SOFTWARE CLASSIFICATION

All installed Telem SCADA software can be divided in to two major groups: software used to configure the SCADA system and the SCADA system itself.

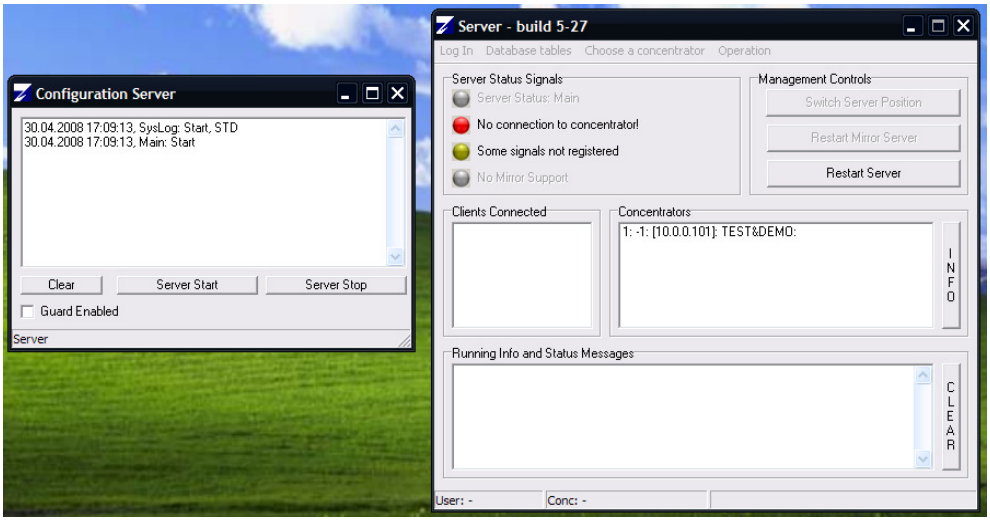
3.1 TELEM SCADA SYSTEM

In addition to MySql and BDE on the Server, there are 2 more programs that have to be working and be properly configured in order to the SCADA system to function correctly:

- **Configuration server** – used to remotely start/stop SCADA server and additional database configuration
- **SCADA Server** – used for primary SCADA operations, essential for proper operation
- **SCADA Client** - used for viewing and controlling SCADA system

Server software should be started only using Configuration server start/stop buttons. If none of the software is running, srv_startup.exe should be used to bring the system online and ensure proper startup of all the programs.

NB. AuthServer and Guard programs from earlier versions of Telem SCADA are obsolete now. The Guard function is implemented in the Configuration server and is enabled by checking the appropriate checkbox in the program.



Screenshot of a running SCADA system with typical setup.

3.2 SCADA CONFIGURATION SOFTWARE

SCADA configuration programs are used to modify SCADA system databases, like adding or deleting new or old analog or digital signals. Configuration tools are used to create and modify substation schematics, which will be displayed by Client. On how to edit schematics, please refer to the section 4: “Schematic designing and associating with database”. Detailed explanation on how to use the configuration tools will come later in this section.

The following programs are used to configure SCADA system:

- **ConfClient.exe** – used for additional database table editing and updating
- **DB_client** – used to remotely modify SCADA database. DB_client offers almost all the functionalities that Server offers locally.
- **Macromedia Flash** – used to create and modify schematics for the substations.

4 SCADA SOFTWARE CONFIGURATION

4.1 CONFIGURATION SERVER

Configuration Server (from now on just 'ConfServer') executable is located by default at Telem_DBS/sbin directory and is executed usually through srv_startup.exe. ConfServer needs ConfServer.conf to run properly which is located by default at Telem_DBS/run directory. ConfServer creates a log file at the same location where it's configuration file lies. The log file is named 'ConfServer.log'.

The configuration file has a standard `'parameter=value'`. Parameter values can be strings of text or numbers, depending of the parameter type. If a parameter is not found or it's value not understood, default value for this parameter will be used.

Example configuration file:

```
[Configuration]
Listen_Port=1610
SystemLog_File=ConfServer.Log
SystemLog_Level=STD
SQL_Database=scada_db
SQL_UserName=sysdba
SQL_Password=pass
Server_Start_Cmd=E:\Telem_DBS\sbin\Server.exe E:\Telem_DBS\run\
Server_PidFile=E:\Telem_DBS\run\Server.PID
Server_Shutdown_FlagFile=E:\Telem_DBS\run\Server.Shutdown.Flag
Schemas_BaseDir=E:\Telem_DBS\build\
Schemas_ExportDir=E:\Telem_DBS\web\schemas\
Guard_Startup=no
```

Explanation of lines:

`[Configuration]`

`Listen_Port=1610` – Port number that ConfServer should listen to Configuration Client connections.

`SystemLog_File=ConfServer.Log` – ConfServer's log file name.

`SystemLog_Level=STD` – Log file messaging level. Available levels: CRIT, STD, WATCH and DEBUG, with first of them logging minimally and only critical messages and every next one logging incrementally more.

`SQL_Database=scada_db` – SCADA database name.

`SQL_UserName=sysdba` – SCADA database user name.

`SQL_Password=pass` – SCADA database user password.

`Server_Start_Cmd=E:\Telem_DBS\sbin\Server.exe E:\Telem_DBS\run\` – Command that will be executed when Server start is requested.

`Server_PidFile=E:\Telem_DBS\run\Server.PID` – PID file for Server status indication.

`Server_Shutdown_FlagFile=E:\Telem_DBS\run\Server.Shutdown.Flag` – Indication file which tells Server to shut down.

`Schemas_BaseDir=E:\Telem_DBS\build\` – Location of Schematics.
`Schemas_ExportDir=E:\Telem_DBS\web\schemas\` – Location of schematics for Server.
`Guard_Startup=No` – Indicates whether Guard is activated on startup.

4.2 SCADA SERVER

Server's configuration file is similar to ConfServer's and has the same structure. A small sample of the configuration file will be displayed here but detailed description of what each line does is described in the configuration file itself for easier configuration. After installation, a sample configuration file with detailed explanation will be copied to the Telem_DBS/run directory.

Small example:

```
#General configuration parameters
[Configuration]

#Port on which server listens for client connections
ClientListenPort=1600

#Port on which server listens for concentrator connections
ConcentratorListenPort=2402

#Directory where ELMO Load Monitoring files are located. Can be
absolute or realtive path
ELMOWorkDir=C:\elmo\DBase\

#Directory where to store log files for each client. Can be absolute
or realtive path
ClientLogDir=E:\Telem_DBS\run\CLog

#Directory where to store Measurement files generated. Can be
absolute or realtive path
MeasureFilesDir=E:\Telem_DBS\run\Measures

#Directory AND filename of the log file. Can be absolute or realtive
path
LogFile=E:\Telem_DBS\run\Server.Log

#Level of logging. Different levels display different
#and different amounts of info.
#available levels:
# CRIT  = only critical messages
# STD   = standard messages
# WATCH = a little more messages than standard
# DEBUG = for debugging only (=HUGE log file)
LogLevel=STD
……
……
…
```

4.3 WORKSTATION CLIENT

Client's configuration file is structured similarly to the rest of the SCADA system. Detailed explanation of each configuration line is included in the configuration file and will not be re-explained here. The default configuration file will be shipped with the installation files and will be copied to the TelemClient directory during installation.

```
[Configuration]
#Server IP's the client should try to connect to
#IP's are separated with a comma (","), example:
#  192.168.0.1,10.0.0.1,127.0.0.1
#NOTE. port count and IP count should MATCH
ServerIPs=127.0.0.1,10.0.0.77

#Server port's to which client should connet to
#ports are separated with comma (","), example:
#  1600,2200,34343
#NOTE. port count and IP count should MATCH
ServerPorts=1600,1600

#Name of the initial schema to be shown after
#succesful login. For Example:
# map
# schema
# startSchema
DefaultSchema=migla

#Enable Automatic Logon of Client
AutoLogin=0

#Automatic Logon Personal Identification Number
AutoLoginPIN=112

#Absolute on realtive path to schemas, for example:
# c:\schemas\
#IF path contains only ONE character, it is used
#to map a drive under that name from \\serverIP\web\
#USING web server user name and password.
PathToSchemas=\\10.0.0.77\telem_schema\Migla\
……
……
```

4.4 DB_CLIENT

DB_Client has a small configuration file named ‘serv_IP.txt’. This file should be in the same directory as the executable file itself. The configuration line consists of two lines, first of which is the IP of the server to connect to and the second is the port used for authentication. The order of lines is important. A sample file is displayed here also:

```
192.168.1.10; IP of the Server.
1620; Port of authentication.
```

4.5 CONFIGURATION CLIENT

Configuration client (from now on just ‘ConfClient’) uses a simple configuration file like the DB_Client. The configuration file is named ‘ConfClient.conf’ and has to be in the same directory as the executable. The configuration file consists of a single line, which has the IP and the port of the Server to be configured. That parameter can be changed and entered when the program is started prior to connecting to Server.

An example configuration file:

```
DefaultServerAddress=127.0.0.1:1610
```

5 SYSTEM CONFIGURATION SOFTWARE

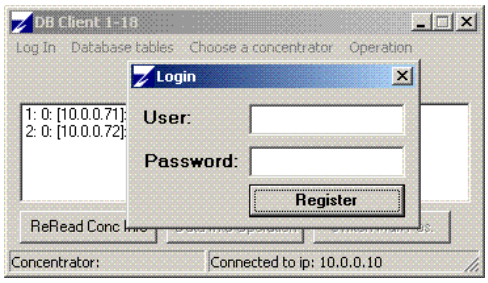
5.1 DB_CLIENT

5.1.1 INTRODUCTION

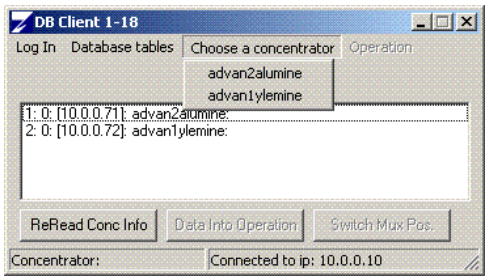
As Server offers all the same capabilities as DB_Client, configuration with them will not be discussed separately. DB_Client can be executed by starting the binary in Telem_DBS/bin directory over the Ethernet. DB_Client can be used directly from another machine also, which has TCP/IP connection to Server machine. In that case, DB_Client.exe, Terms_DB_Serv.txt and serv_IP.txt have to be copied to that particular machine. All the files copied should be located in the same directory on the target machine.

5.1.2 PROGRAM MENUS

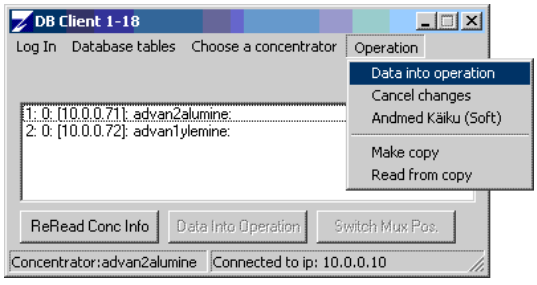
After starting the program and pressing the menu 'Log In' a window, like the one on the right, appears. Type in the credentials and press the button 'Register'.



After a successful registration the concentrator can be chosen from the menu 'Choose a concentrator'. After the concentrator is chosen, the 'Database tables' menu becomes active and database tables can now be edited. A detailed description on what each table does and how it can be modified will come in the section 7.



After database table editing is finished changes can be committed to the active system by choosing 'Data into operation' from the 'Operation' menu. Changes can be cancelled by choosing 'Cancel changes' from the same menu.



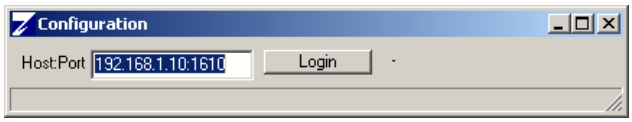
Almost all the tables in the database have common editing controls in the bottom of the table. These controls help the user to move around the database and make modifications to the database more easily. The functions of these buttons are as follows from left to right: move to and activate the first record in the database, step back and activate the previous record in the database, step forward and activate the next record in the database, move to and activate the last record in the database, add a new record before

the activated record and activate the new one, delete the active record and commit all changes to the database.

5.2 CONFCLIENT

5.2.1 INTRODUCTION

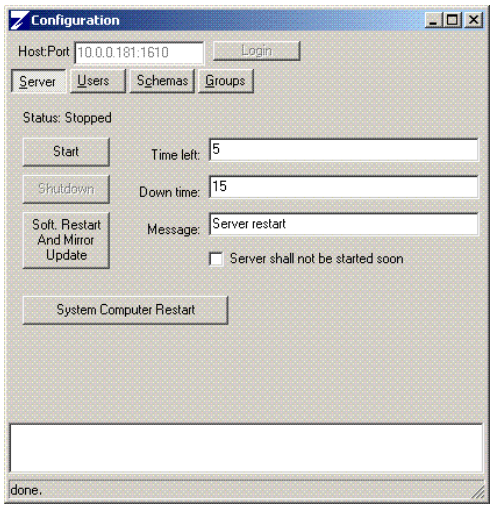
ConfClient can be executed over the network from Server's Telem_DBS/bin directory or ConfClient.exe and ConfClient.conf can be copied to another machine, which has TCP/IP access to Server. Upon execution the following window will be displayed:



Type in the IP address of the Server that needs configuration and press 'Login'. The default IP address and port can be changed from the configuration file. By using appropriate pages in the program the desired changes can be done. Upon finishing configuration, the program can be simply closed. Detailed explanation of what can be done in the different configuration pages will be explained shortly.

5.2.2 'SERVER'

This page allows controlling of Server. Server can be stopped and started with the appropriate buttons. In addition the whole SCADA system can be restarted from here, by using the 'System Computer Restart' button.



'Soft. Restart And Mirror Update' button can be used to update the hot-standby Server when the other pages have changed.

'Time Left' field can be used to tell Server after how many minutes it should close.

'Down time' field can be used to tell Client the approximate down time.

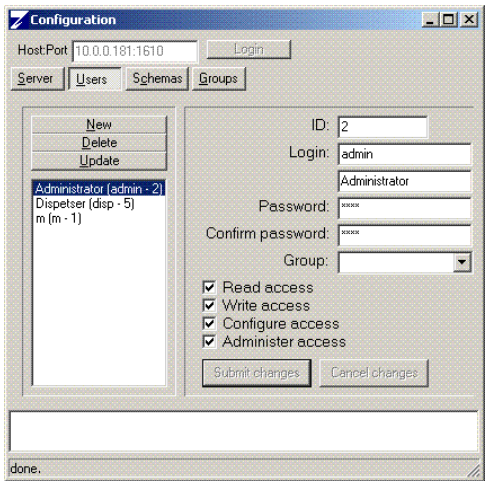
'Message' field can be used to send all the clients a message after the 'Shutdown' button is pressed.

5.2.3 'USERS'

If the current configuring user has configuration access, then the user can add/edit/delete other users in the system by using the appropriate controls.

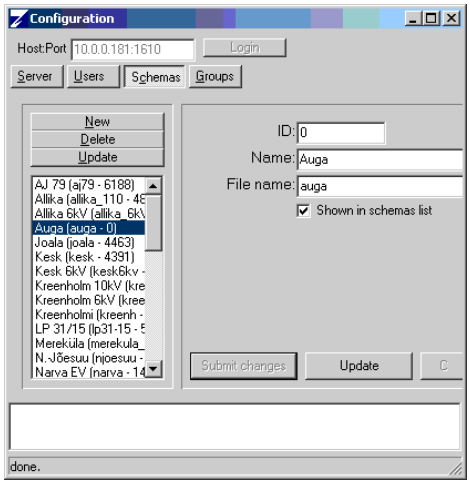
Field descriptions:

- ID – unique number to identify the user
- Login – User name used to log in to the system
- Real name – User's real name
- Password – User's password
- Confirm password – User's password confirmation



- Group – Group the user belongs to
- Read access – Right to observe the system
- Write access – Right to perform control operations
- Configure access – Right to configure system
- Administrative access – Right to add/edit/delete other system users

5.2.4 'SCHEMATICS'

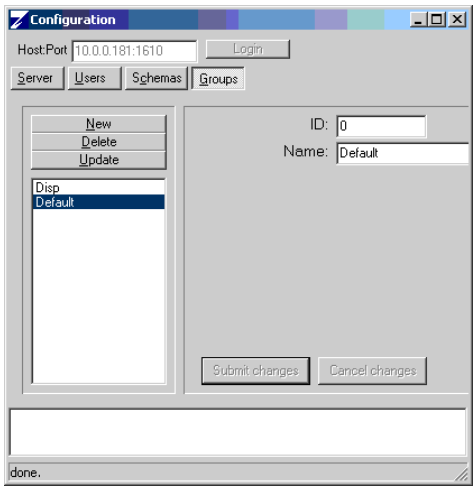


If the current configuring user has configuration access, then the user can modify/add/remove schematics used in the system. After every modification the 'Submit Changes' button has to be pressed in order for the changes to take effect.

For further information please refer to the section 4: "Schematic designing and associating with database".

5.2.5 'GROUPS'

If the current configuring user has administrative access, then the user can modify/add/remove groups available in the system. Every user and object in the system is associated with a group. This helps to make only needed objects and events visible to a certain group of users.



Field descriptions:

- ID – Unique group identifier. If the group's ID is zero, then the group sees all the possible events and objects in the system.
- Name – Name of the group

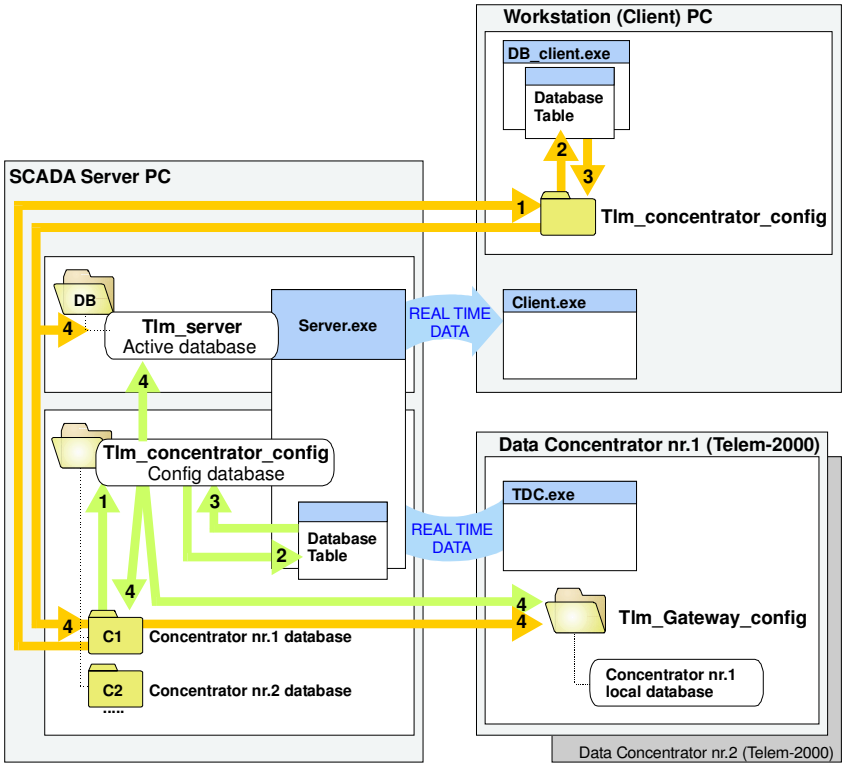
Upon completion, press 'Submit changes' or 'Cancel changes' to submit or cancel changes respectively.

6 FILLING SYSTEM CONFIGURATION DATABASE

6.1 INTRODUCTION

When database is edited with either Server or DB_Client the database files for the appropriate TDC are copied according to this:

- After the TDC is chosen from the 'Choose a concentrator' menu for editing, all database files are copied from the appropriate database folder (C1, C2 etc) to the root of the folder 'Tlm_concentrator_config'.
- After choosing a TDC, the database tables can now be edited from the menu 'Database tables'.
- After editing the tables and closing all open windows, the changes will be saved to the database files located in the root of 'Tlm_concentrator_config'.
- Changes can be incorporated into the active database by using 'Data into operation' from 'Operation' menu. After that the files will be automatically copied to the appropriate TDC database folder on the Server machine (C1, C2 etc), to the appropriate TDC machine over the Ethernet and transferred to the active database in MySql.



6.2 SETTING UP DATABASE TABLES

SCADA System configuration database tables have to be filled by the System administrator. Number of records in these tables is unlimited. The following table represents these editable tables and relations with software.

Table name	Used by		Edited with	After editing restart
	Server	TDC		
Users	+		ConfClient Server	
Schemas	+		ConfClient	Server
Concentrators	+	+	Server	After editing please select 'Data into operation' from the 'Operations' menu. This will restart TDC on Concentrator machine also.
Groups	+	+	Server DB_Client	
Substations	+	+		
Objects	+	+		
Channels	+	+		
Controllers	+	+		
Upper channels	+	+		

Notes:

- Table 'Users' can be edited using Server only and if user logged in has administrative rights.
- Table 'Schemas' must be corrected if a new schematic is added to the system or some object's name on the schematics have changed.
- Table 'Concentrators' can be edited only using DB_client or Server.

6.3 TABLE 'USERS'

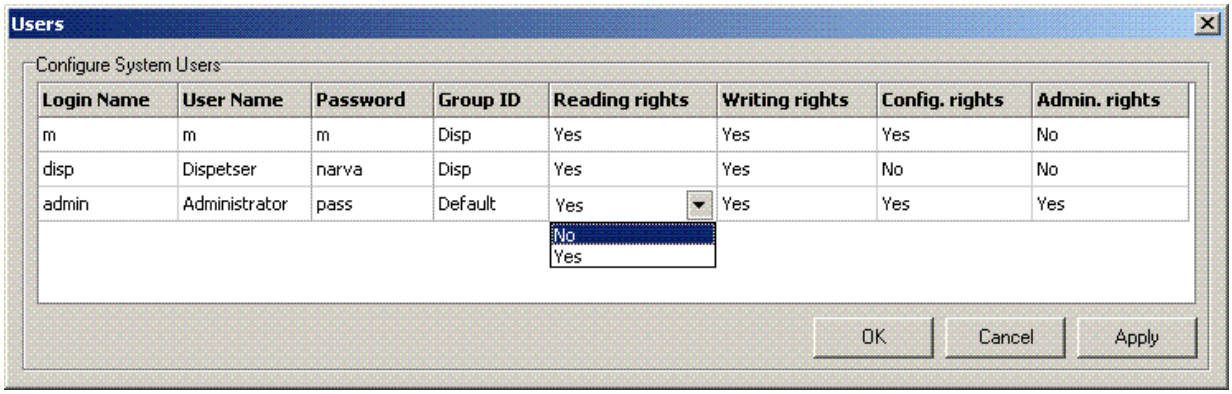
All the users in the SCADA system have to be listed here. This table can be filled and edited with either Server or ConfClient.

6.3.1 USING SERVER

When Server is running properly do the following:

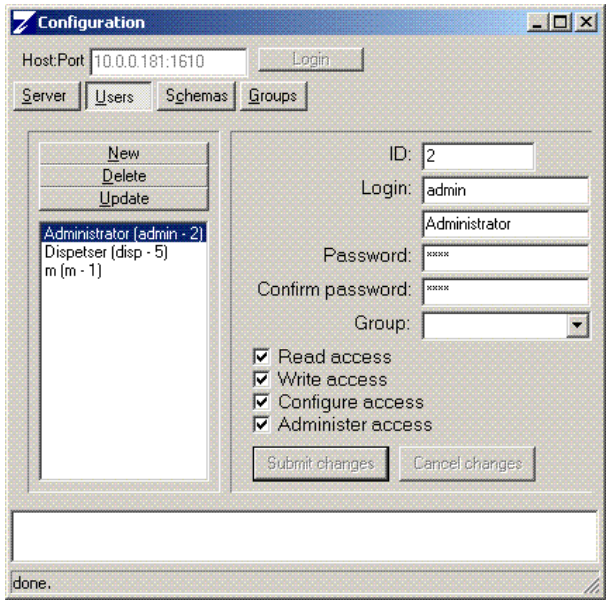
- Log in as an existing user with administrative rights.
- Open the table 'Users' from the menu 'Database tables'.

- Make the necessary modifications.
- Adding and removing users can be done using right clicking on the table.
- All changes made here are effective immediately and no 'Data into operation' command is required.



6.3.2 USING CONFCLIENT

When ConfClient is running and the user with administrative rights has logged in, the user's database modifications can be like this:



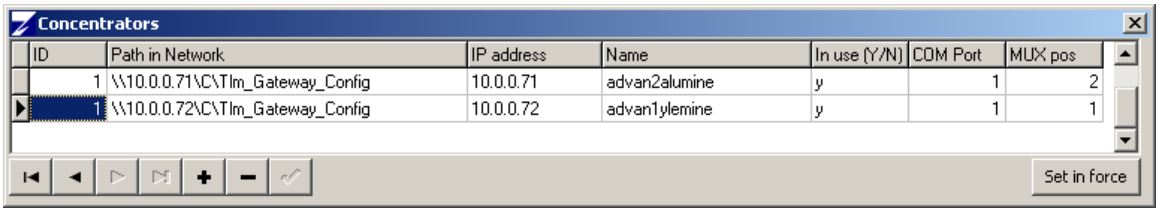
- Open the 'Users' tab in the program.
- Press the 'New' button to make a new user.
- Fill in the required fields for the new user.
- To commit changes press 'Submit changes'.
- To delete a user, first select it and then press 'Delete'.
- To edit a user, select it first, modify the required fields and press 'Submit changes' to commit the changes.

Field descriptions:

- ID – Unique identification number.
- Name – User's real name.
- Password – User's password.
- Group – The name of the group the user belongs to.
- Read access – Right to observe the system
- Write access – Right to perform control operations
- Configure access – Right to configure system
- Administrative access – Right to add/edit/delete other system users

6.4 TABLE 'CONCENTRATORS'

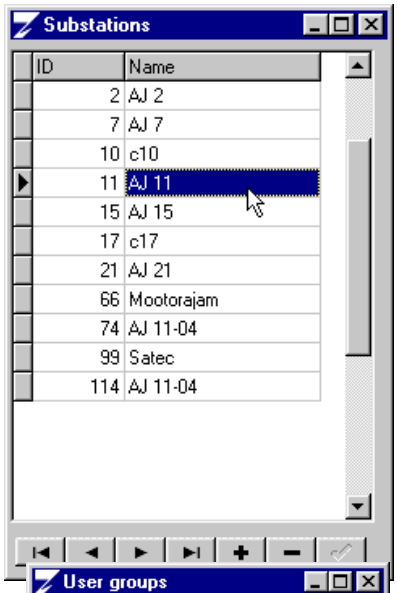
All TDC's used in the SCADA system have to be configured in this table. This table can be edited either using DB_Client or Server.



Field descriptions:

- ID: Unique identifier (Duplicate ID's mean that one of them is in hot-standby).
- Path in Network – Database's network or local path.
- IP address – IP address of the TDC.
- Name – Name of the TDC.
- In Use – Specifies whether the TDC is in use.
- Com Port – Number of the Com port to which the TDC's MUX controller is connected to.
- Mux Pos – The position the MUX has to be in for this particular TDC.

6.5 TABLE 'SUBSTATIONS'



All the stations in the SCADA system have to be named here.

Field descriptions:

- ID – Unique identifier. This ID is used in the database table 'Objects'
- Name – Name of the Substation with max 20 symbols. This name will appear in various events and messages also.

Note:

It is recommended to choose ID numbers with some logical connection to the substation names, if possible.

6.6 TABLE 'GROUPS'

All the groups used in the SCADA system must be entered to this table. This table can be edited with either DB_Client or Server.

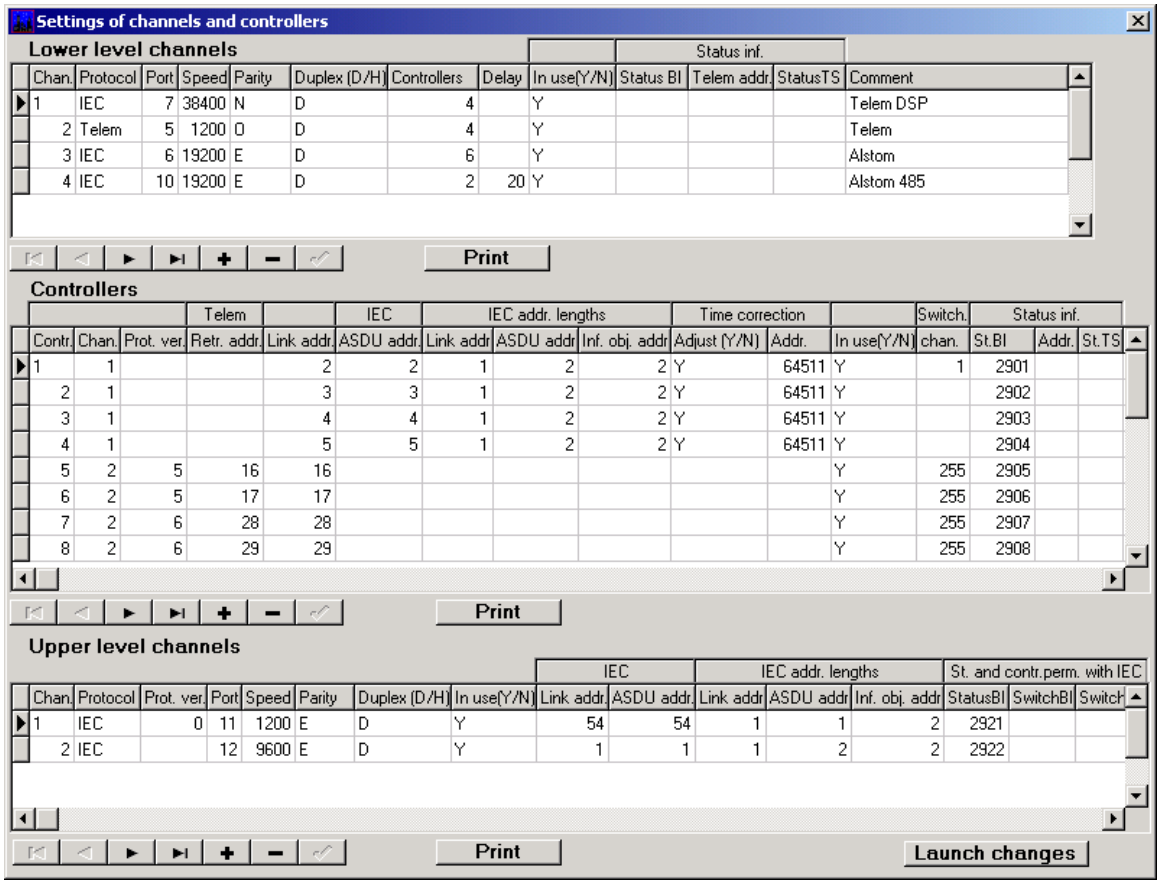
Field descriptions:

- ID – Unique identification number. This ID is used also in the table 'Objects'.

- Name – Name of the group with max 20 symbols.

6.7 COMMUNICATION CHANNELS AND CONTROLLERS

The following tables can be edited by choosing 'Channels and controllers' form the menu 'Database tables'.



6.7.1 TABLE 'LOWER LEVEL CHANNELS'

In this table the communication channels to substation devices are configured.

Column Controllers is filled automatically, user should not fill this column.

Table columns have the following contents:

- Channel – Used for binding this table row with other tables. Table can't have two rows with same channel number.
- Protocol – Communication protocol, which is used by all devices in this channel (TELEM, IEC, DNP, MODBUS or IEC_Cour)
- Port – Number of the communications port. This value should not be used for other lower or upper level channels, except in case of offline channels where the same COM port number can be used for several lower level channels.

- Speed – Communication speed for all devices in this channel.
- Parity – The use of parity bit for all devices in this channel. Possible values: N – not in use; O – odd; E – even.
- Duplex (D/H) – Determines whether this channel is in full- or half duplex mode. Possible values are D and H.
- Controllers – The number of controllers in Controllers table, which are connected to this channel. This field is corrected automatically on launching the changes and on program startup.
- Delay – Delay between receiving data and next query in milliseconds.
- In use (Y/N) – Determines whether this channel is currently in use.
- Status inf. / Status BI – ID number of "Internal" BI object, which is used for representing the communication status of the channel (OK or failure).
- Status inf. / Telem addr. – Number of virtual Telem controller (status controller), where the channel's status mark is held. This number must not be in use on any controller's "Retr. addr." field in Controllers table. In setup the minimum possible number of different addresses should be used for status information.
- Status inf. / Status TS – Number of virtual TELEM controller's binary input, which is used for representing the communication status of the channel (OK or failure).
- Comment – Short description or name (up to 20 symbols)
- Phone # – Phone number for offline channel. If the * is added before the number, then the Gateway expects the callback from RTU side. Offline channels usually share the same COM port (same GSM modem).
- Max.t.[s] – Maximum connection time in seconds for offline channel.
- Inq.int.[m] – Periodical inquiry interval in minutes for offline channels. After this time period the Gateway dials to remote RTU for collecting all data.
- Con.TC – This is used only together with upper level Telem protocol. It is the number of virtual TELEM controller's binary output used for creating the offline connection.
- Con.TS – This is used only together with upper level Telem protocol. It is the number of virtual TELEM controller's binary input used for indicating the presence of offline connection.
- Con.BO – This is used together with upper level IEC 60870-5-101 protocol or SCADA server. It is the upper level object address of internal control object for creating the offline connection.
- Con.BI – This is used together with upper level IEC 60870-5-101 protocol or SCADA server. It is the upper level object address of internal BI object for indicating the presence of offline connection.

6.7.2 TABLE 'CONTROLLERS'

The communication parameters of substation devices are configured in this table.

Table columns have the following contents:

- Contr. – Used for binding this table row with other tables. Table can't have two rows with same controller number.
- Channel – Specifies the lower level channel, to which the controller is connected. Lower level channels table must have the row with this channel no. Controllers table can have up to 8 rows with the same channel no.
- Prot. ver. – The number of protocol version. Used protocol is specified in table of lower level channels.

Possible TELEM protocol versions:

- 4 – TELEM-2
- 5 – TELEM-2A
- 6 – TELEM-2C
- 7 – TELEM- TS events recorder
- 9 – TELEM - TM 120
- 14 – TELEM-2 without energy enquiry
- 15 – TELEM-2A without energy enquiry
- 16 – TELEM-2C without energy enquiry

Possible IEC 60870-5-101 protocol versions:

- 0 – Measurement time = time tag + hour and date, got with time synchronization message (ABB)
- 1 – Measurement time = time tag + hour and date from Gateway computer (Siemens)
- 2 – Same as ver. 0 with Gateway computer's time correction from lower level devices (ABB)

Possible IEC 60870-5-103 protocol versions:

- 103 – Normal
- 102 – If the reception is always enabled on RS-422 and

  RS-485 channels.

- Telem / Retr. addr. – Retranslation address is the address of virtual TELEM controller, used by dispatch centers (upper level channels) for accessing the information. It can be same value with 'Link aadr.' field.
- Link addr. – The address of substation device.
- IEC / ASDU addr. – The address of data unit in device.

- IEC addr. lengths / Link addr. – Length of link address in bytes.
- IEC addr. lengths / ASDU addr. – Length of ASDU address in bytes.
- IEC addr. lengths / Inf. obj. addr. – Length of information object address in bytes.
- Time correction / Adjust. (Y/N) – Determines, is the IEC or Telem device's time corrected by Gateway computer 5 min. after every hour.
- Time correction / Addr. – Address of time object in IEC device. Not used, if previous field has value "N".
- In use (Y/N) – Determines, is the controller currently in use.
- Switch. chan. – Used only in case of TELEM – TELEM conversion. This is the number of upper level channel, which is normally (by default) used for making switching operations of this TELEM device.
- Status inf. / Status BI – ID number of "Internal" BI object, which is used for representing the communication status of the channel (OK or failure).
- Status inf. / Telem addr. – Number of virtual Telem controller (status controller), where the controller's status mark is held. This number must not be in use on any controller's "Retr. addr." field of Controllers table.

In setup the minimum possible number of different addresses should be used for status information.

- Status inf. / Status TS – Number of virtual TELEM controller's binary input, which is used for representing the communication status of the channel (OK or failure).
- Comment – Short description or name (up to 20 symbols)
- Failure TS – This is used on offline connection only together with upper level Telem protocol. It is the number of virtual TELEM controller's binary input used for indicating the communication status of RTU on last offline connection. It has value "1" if the RTU didn't communicate on last offline connection.
- Failure BI – This is used on offline connection together with upper level IEC 60870-5-101 protocol or SCADA server. It is the upper level object address of internal BI object for indicating the communication status of RTU on last offline connection. It has value "1" if the RTU didn't communicate on last offline connection.

6.7.3 TABLE 'UPPER LEVEL CHANNELS'

In this table the communication channels to dispatch centers are configured. Via these channels the virtual TELEM controllers or IEC, COURIER protocol objects are queried.

Table columns have the following contents:

- Channel – Used for binding this table row with other tables. Table can't have two rows with same channel number.
- Protocol – Communication protocol, which is used on this channel (TELEM or IEC).

- Prot. ver. – The number of protocol version.

Possible TELEM protocol versions:

  - 1 – Satelliit
  - 6 – TELEM-2C

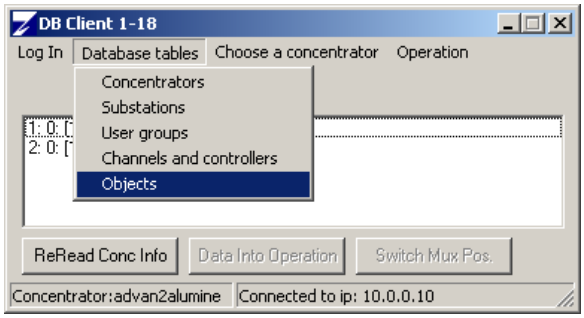
Possible IEC protocol versions:

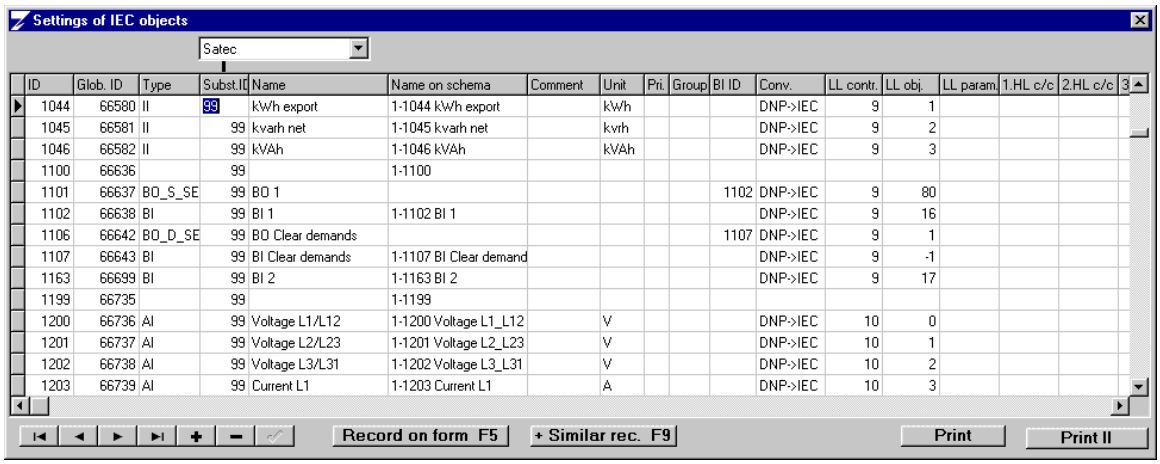
  - 2 – Time correction from upper level

- Port – Number of communication port.
- Speed – Communication speed of this channel.
- Parity – The use of parity bit for this channel.
- Possible values: N – not in use; O – odd; E – even.
- Duplex (D/H) – Determines, is the full- or half duplex mode used on this channel. Possible values are D and H.
- In use (Y/N) – Determines, is the channel currently in use.
- Status and … / Status BI – ID number of “Internal” BI object, which is used for representing the communication status of the channel (OK or failure).
- Status and … / Switch. BI – ID number of “Internal” BI object, which represents the grabbing of all switching permissions (are all switching permissions grabbed by the dispatch center, which uses this channel).
- Status and … / Switch. BO – ID number of “Internal” BO object, which is used for grabbing all switching permissions. Switching this binary output to “ON” causes the grabbing of all permissions. Switching it to “OFF” restores the normal permissions.
- Status and … / Telem addr. – Number of virtual Telem controller (status controller), where the channel’s status information is held. This number must not be in use on any controller’s “Retr. addr.” field of Controllers table. In setup the minimum possible number of different addresses should be used for status information.
- Status and … / Status TS – Number of virtual TELEM controller’s binary input, which is used for representing the communication status of the channel (OK or failure).
- Status and … / Switch. TS – Number of virtual TELEM controller’s binary input, which represents the grabbing of all switching permissions (are all switching permissions grabbed by the dispatch center, which uses this channel).
- Status and … / Switch. TC – Number of virtual TELEM controller’s binary output, which is used for grabbing all switching permissions. Switching this binary output to “ON” causes the grabbing of all permissions. Switching it to “OFF” restores the normal permissions.
- Comment – Short description or name (up to 20 symbols)

6.8 MEASUREMENT AND CONTROL OBJECTS

'Objects' can be accessed via the menu 'Database tables'. The table contains information on objects parameters, source and destination devices and addresses.





ID	Glob. ID	Type	Subst.ID	Name	Name on schema	Comment	Unit	Pri.	Group	BI ID	Conv.	LL contr.	LL obj.	LL param.	1.HL c/c	2.HL c/c
1044	66580	II	99	kWh export	1-1044 kWh export		kWh				DNP->IEC	9	1			
1045	66581	II	99	kvarh net	1-1045 kvarh net		kvrh				DNP->IEC	9	2			
1046	66582	II	99	kVAh	1-1046 kVAh		kVAh				DNP->IEC	9	3			
1100	66636		99		1-1100											
1101	66637	BO_S_SE	99	BO 1						1102	DNP->IEC	9	80			
1102	66638	BI	99	BI 1	1-1102 BI 1						DNP->IEC	9	16			
1106	66642	BO_D_SE	99	BO Clear demands						1107	DNP->IEC	9	1			
1107	66643	BI	99	BI Clear demands	1-1107 BI Clear demand						DNP->IEC	9	-1			
1163	66699	BI	99	BI 2	1-1163 BI 2						DNP->IEC	9	17			
1199	66735		99		1-1199											
1200	66736	AI	99	Voltage L1/L12	1-1200 Voltage L1_L12		V				DNP->IEC	10	0			
1201	66737	AI	99	Voltage L2/L23	1-1201 Voltage L2_L23		V				DNP->IEC	10	1			
1202	66738	AI	99	Voltage L3/L31	1-1202 Voltage L3_L31		V				DNP->IEC	10	2			
1203	66739	AI	99	Current L1	1-1203 Current L1		A				DNP->IEC	10	3			

6.8.1 FIELD DESCRIPTIONS

Column	Description	Example	Used by
ID	Unique identification number (1...65536) for a object in this data concentrator	1	must be always filled, regardless of the object type.
Glob. ID	Global identification number, unique in this SCADA system. Glob. ID is filled automatically. User should not fill this column.	65537	

Type	Object's type, which can have values: o AI Analog measurement o BI Binary input o BI_F o B_PS Binary pseudo o II Integrated input (pulse counter) o BO_S_SE Binary output (single, select & execute) o BO_S_E Binary output (single, execute) o BO_D_SE Binary output (double, select & execute) o BO_D_E Binary output (double, execute) o A_FORM Analog formula o D_FORM Digital formula Note: If type is B_PS, A_FORM or D_FORM, protocol conversion type must be "Internal".	AI	
Subst. ID	Substation's identification number (from table Substations"), where this object belongs.	2	
Name	Object's name, up to 64 symbol	Switch 1	
Name on Schematic	Object's name on schema, consists from concentrator o., ID and additional part (the full or simplified object's name). This column is filled automatically.	1-1 Switch 1	
Comment	Short description (up to 20 symbols)		
Unit	Unit only for AI (analog input) object, up to 4 symbol	KV	AI
Pri.	Object's priority in tables "Messages" and "History" Priority must be between 1(highest) and 5. If this field is empty or 0, object is without any priority and system generates no events.	2	All types
Group	User group identification number (from table "User groups"), where this object belongs. If this field is empty, user group is "default".	1	
BI ID	Only for BO objects: binary input object ID, connected with this BO (binary output) object	1	BO
Conv.	Type of protocol conversion (Internal, TLM->IEC, IEC->IEC, COR->IEC, DNP->IEC).	IEC -> IEC	All types

LL contr.	Lower level controller number (from table "Controllers")	127	All types, if conv type is not "Internal"
LL obj.	Object no. in lower level controller.	11	
LL param.	Lower level object's parameter (additional information). On binary outputs. It can have values: o N_I No additional information (same as leaving blank) o S_P Short pulse o L_P Long pulse o PRS Persistent On COURIER protocol binary inputs. It specifies the bit no in BI objects word. It can have extension for specifying the conformed control operation type. Examples: o 2 2nd bit of BI objects word o 6T 6th bit represents the control o Operation's "Trip" conformation o 7C 7th bit represents the control o Operation's "Close" conformation		
1. HL c/c	1. HL c/c Higher level channel or controller number On IEC protocol this is the number communication channel from the table "Upper level channels". On TELEM protocol this is the number of virtual Telem controller. This number must not be in use on any controller's "Retr. addr." field of Controllers table.		
2. HL c/c	2. HL ch. Second higher level IEC channel. It is used only on higher level IEC protocol.		
3. HL c/c	3. HL ch. Third higher level IEC channel		
4. HL c/c	4. HL ch. Fourth higher level IEC channel		
5. HL c/c	5. HL ch. Fifth higher level IEC channel		
HL obj	Object number on sending the value to higher level. On TELEM protocol this is the input no. of virtual TELEM controller.		
HL cop.chan.	Used only with binary output (BO) objects. This is number of upper level channel, which is normally (by default) used for making control operations of BO object.		

DeadB	Dead band - (percentage from full scale) is used on conversions to IEC. It determines the minimal change of value, which causes sending it with IEC protocol to higher level. Default value (empty field) is 1%.	0.01	AI
Min val.	Minimum scale value	7.5	
Max val.	Maximum scale value	12.5	
Zero lim.	Zero limit - all measurement values, lower as zero limit, will have value zero.	7.4	
Norm. val.	Normal value, which can be for binary objects: 0 - indefinite; 1 - open; 2 - close; 3 - invalid	2	BII
Digits	Maximum number of digits	4	AI
Digits a. c.	Number of digits after comma	1	
Alm. min.	Minimum value of measurement, which generates "alarm" message	9.7	
Alm. max.	Maximum value of measurement, which generates "alarm" message	10.5	
Crit. min.	Minimum value of measurement, which generates "critical" message	9.5	
Crit. Max.	Maximum value of measurement, which generates "critical" message	11	
Event log.	Event logging - values "Y" or "N". If event logging is disabled, periodical logging is disabled too.	Y	AI and BI
Period log.	Periodical logging - values "Y" or "N"	Y	AI
Per. log. int.	Periodical logging interval (seconds). Default value (empty field) is 60 sec	30	
Act. state name	Active state name (if empty, name from file server.conf)	Signal On	BI
Pass. state. name	Passive state name (if empty, name from file server.conf)	Signal Off	
Act. event name	Active event name (if empty, name from file server.conf)	Signal Start	
Pass. event name	Passive event name (if empty, name from file server.conf)	Signal Stop	

Board	If this BI signal is displayed on mimic board - board address (controller number)	13	
B.c.outp.	If this BI signal is displayed on mimic board - mimic board output (controller output pin number)	48	
Alarm	If 'Y' then appears in alarms list when out of norms state. Otherwise 'N'	N	All
Inversioon	Inverts the objects value in concentrator	Y	BI

6.8.2 EDITING 'OBJECTS' TABLE RECORD ON THE FORM

Form editing of objects can be done by pressing 'F5' in the when the 'Objects' table is opened, or by pressing the button 'Record on form F5' in the 'Objects' table. Form is closed using the same button. Fields on this form correspond to the correct fields in the table. All the fileds can be dived to the following groups:

Fields, must be filled or checked (exists for most object types).

Substation: Choice from table "Substations"

Name: Object's name, up to 64 symbol

Type: Object's type, which can have values: AI, BI, B_PS, II, BO_S_SE, BO_S_E, BO_D_SE, BO_D_E, A_FORM, D_FORM

User group: Choice from table "User groups"

Priority: Object's priority in tables "Events" and "History". Priority must be between 1 and 5.

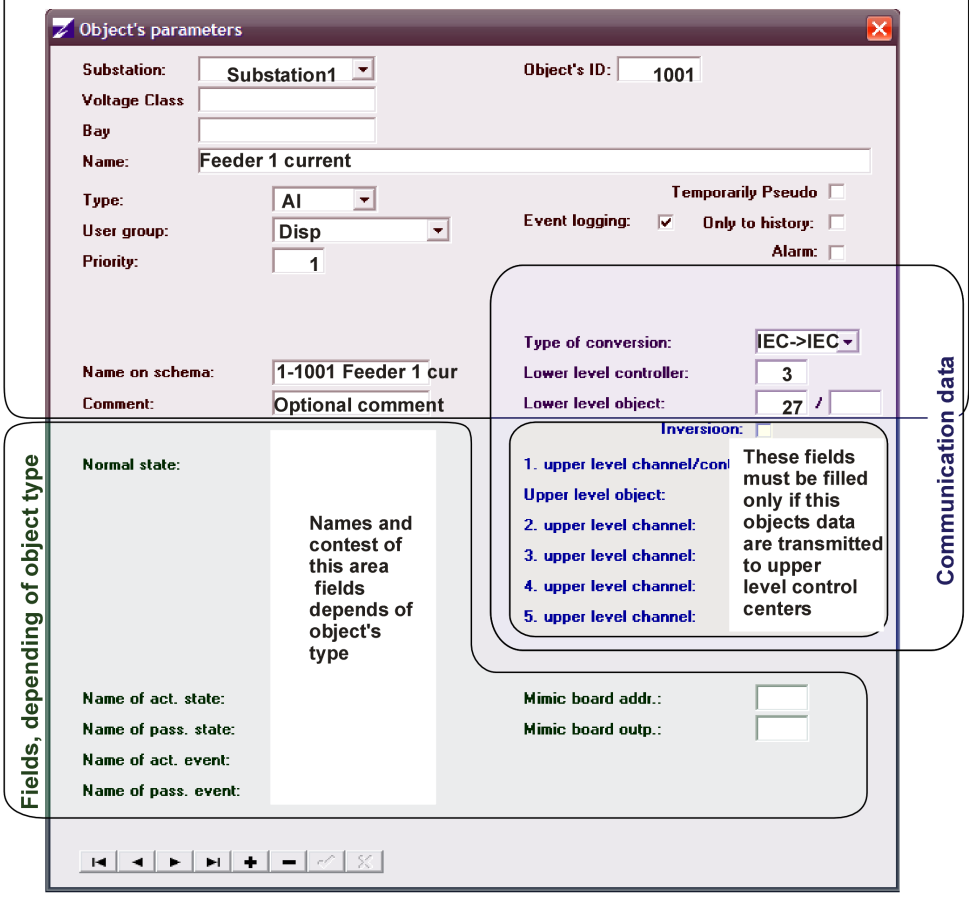
Name on schema: Object's name on schema, consists from concentrator no., ID and additional part (the full or simplified object's name). **This field is filled automatically.**

Objet's ID: Unique identification number (1…65536) in this data concentrator, which can't be same for two rows. Table objects is sorted by this number.

Type of protocol conversion: Type of protoco conversion (Internal,TLM->IEC,IEC->IEC, COR->IEC, DNP->IEC)

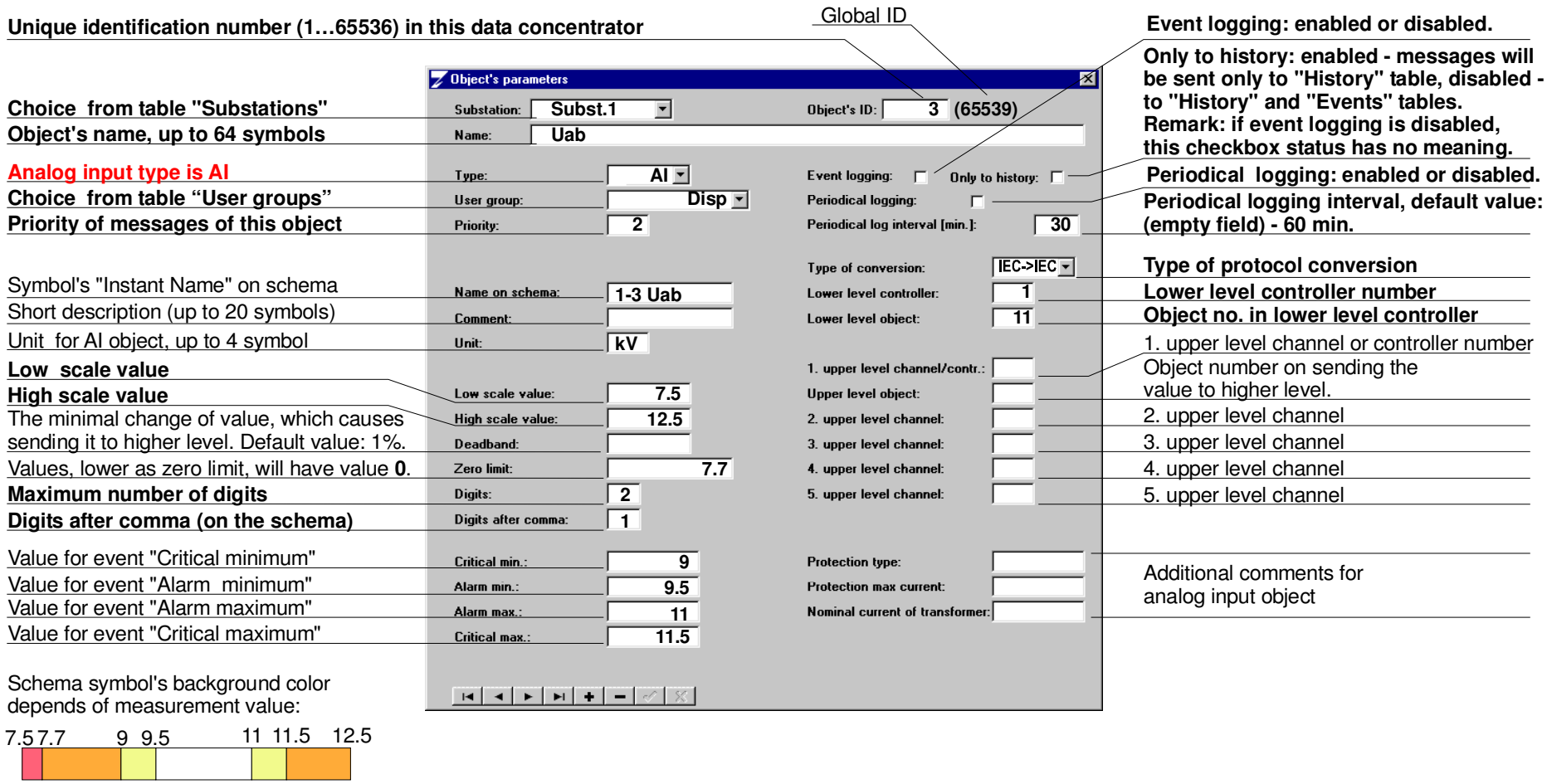
Note: If conversion type is "Internal", fields "Lower level contr." and "Lower level obj." are not in use.

Lower level contr.: Lower level controller number (from table "Controllers")
Lower level obj.: Object no. in lower level controller.



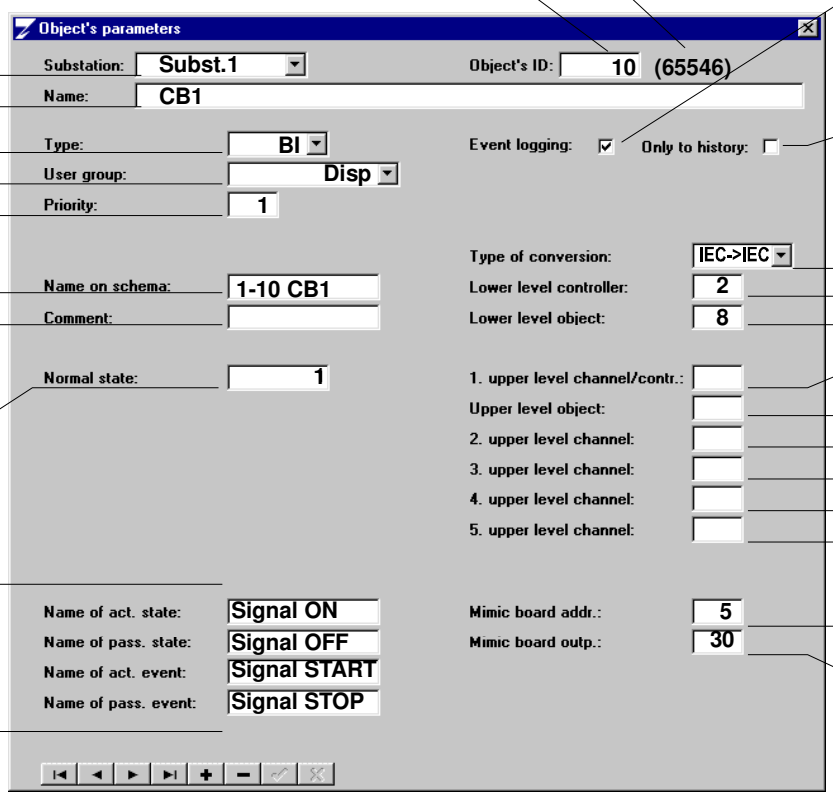
6.8.2.1 SETTING UP 'AI'

Fields description, must be filled or checked, s in **bold.**



6.8.2.2 SETTING UP 'BI'

Fields description, must be filled or checked, s in **bold.**



Unique identification number (1…65536) in this data concentrator

Global ID

Event logging: enabled or disabled.

Only to history: enabled - messages will be sent only to "History" table, disabled - to "History" and "Events" tables. Remark: if event logging is disabled, this checkbox status has no meaning.

Choice from table "Substations"

Object's name, up to 64 symbols

Binary input type is BI

Choice from table "User groups"

Priority of messages of this object

Symbol's "Instant Name" on schema

Short description (up to 20 symbols)

Normal state can have values:
0 - indefinite
1 - open
2 - close
3 - invalid
Normally is used 1 or 2.

Type of protocol conversion

Lower level controller number

Object no. in lower level controller

1. upper level channel or controller number

Object number on sending the value to higher level.

2. upper level channel

3. upper level channel

4. upper level channel

5. upper level channel

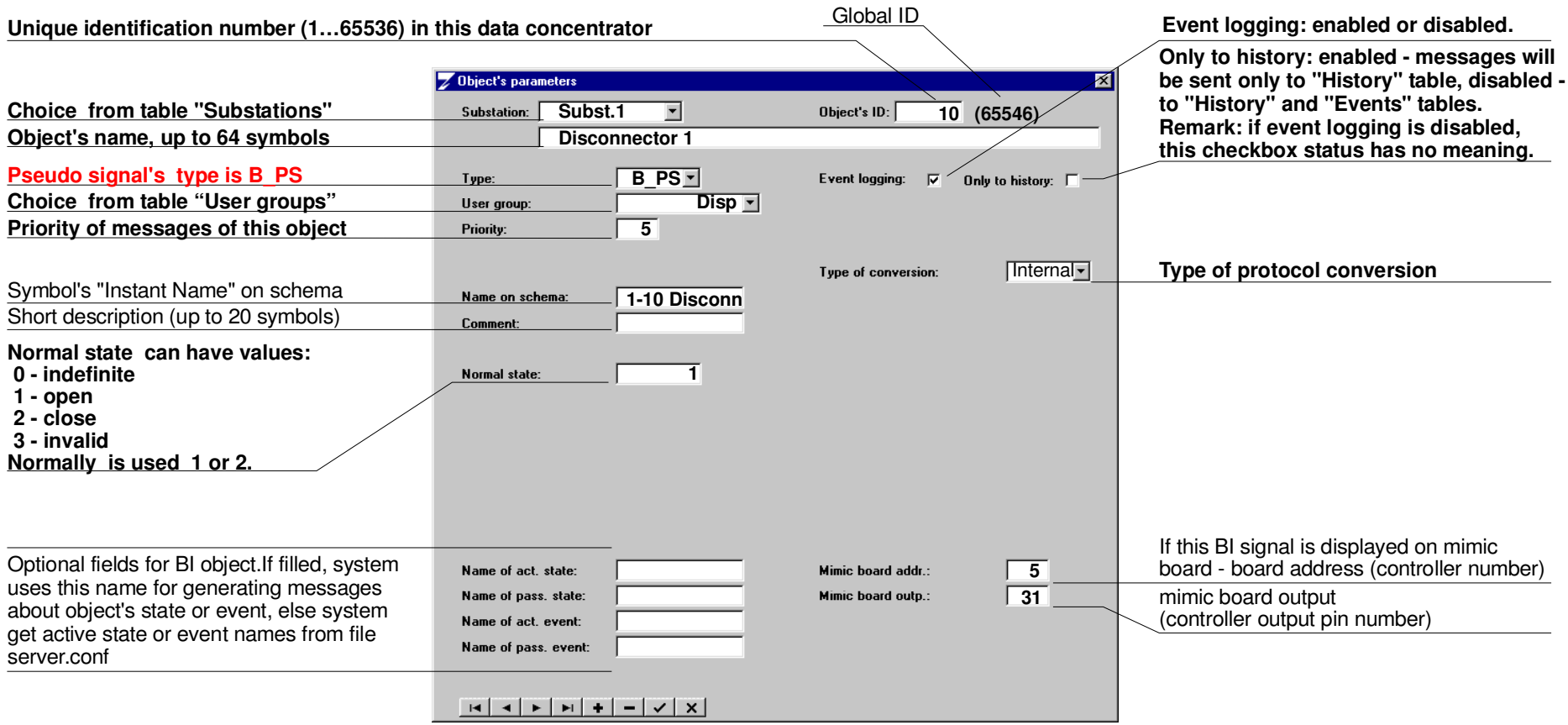
Optional fields for BI object.If filled, system uses this name for generating messages about object's state or event, else system get active state or event names from file server.conf

If this BI signal is displayed on mimic board - board address (controller number)

mimic board output (controller output pin number)

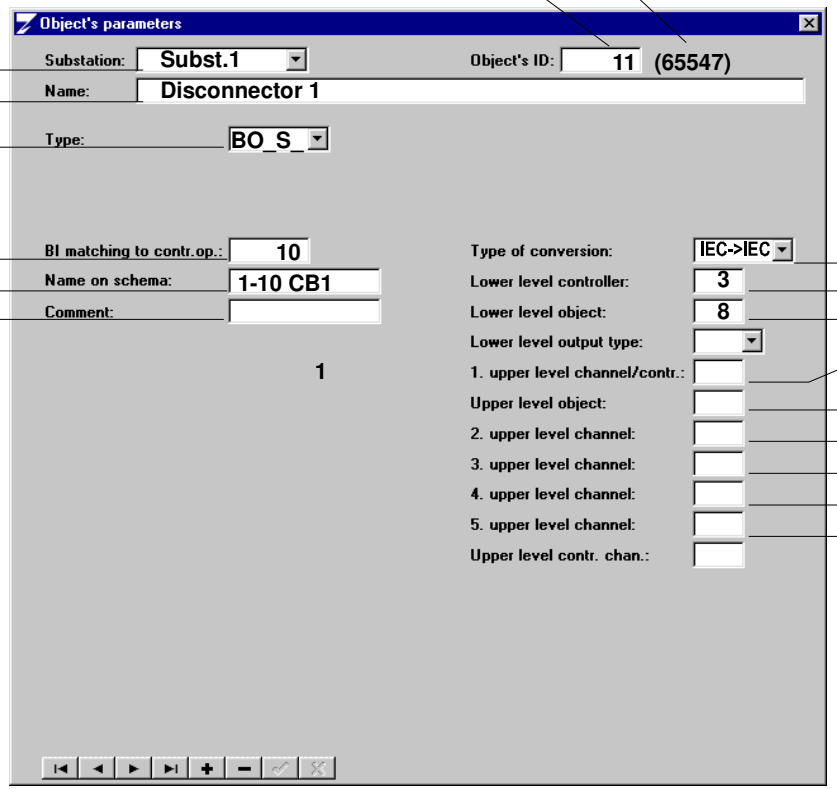
6.8.2.3 SETTING UP 'B_PS'

Binary pseudo object's record is similar to BI-object's record, corresponding fields on form must be filled like for BI-objects.
Fields description, must be filled or checked, is in **bold.**



6.8.2.4 SETTING UP 'BO'

Fields description, must be filled or checked, is in **bold.**



Unique identification number (1…65536) in this data concentrator

Global ID

Choice from table "Substations"

Object's name, up to 64 symbols

Binary output's type is BO_...

Describes logical connection between BI and BO objects. Clicking on schema symbol with this ID will open window for control corresponding BO object.

Name on schema is not in use

Short description (up to 20 symbols)

Binary output object's type can have values:

BO_S_SE
- Binary output (single, select & execute)

BO_S_E
- Binary output (single, execute)

BO_D_SE
- Binary output (double, select & execute)

BO_D_E
- Binary output (double, execute)

Type of protocol conversion

Lower level controller number

Object no. in lower level controller

1. upper level channel or controller number
Object number on sending the value to higher level.

2. upper level channel

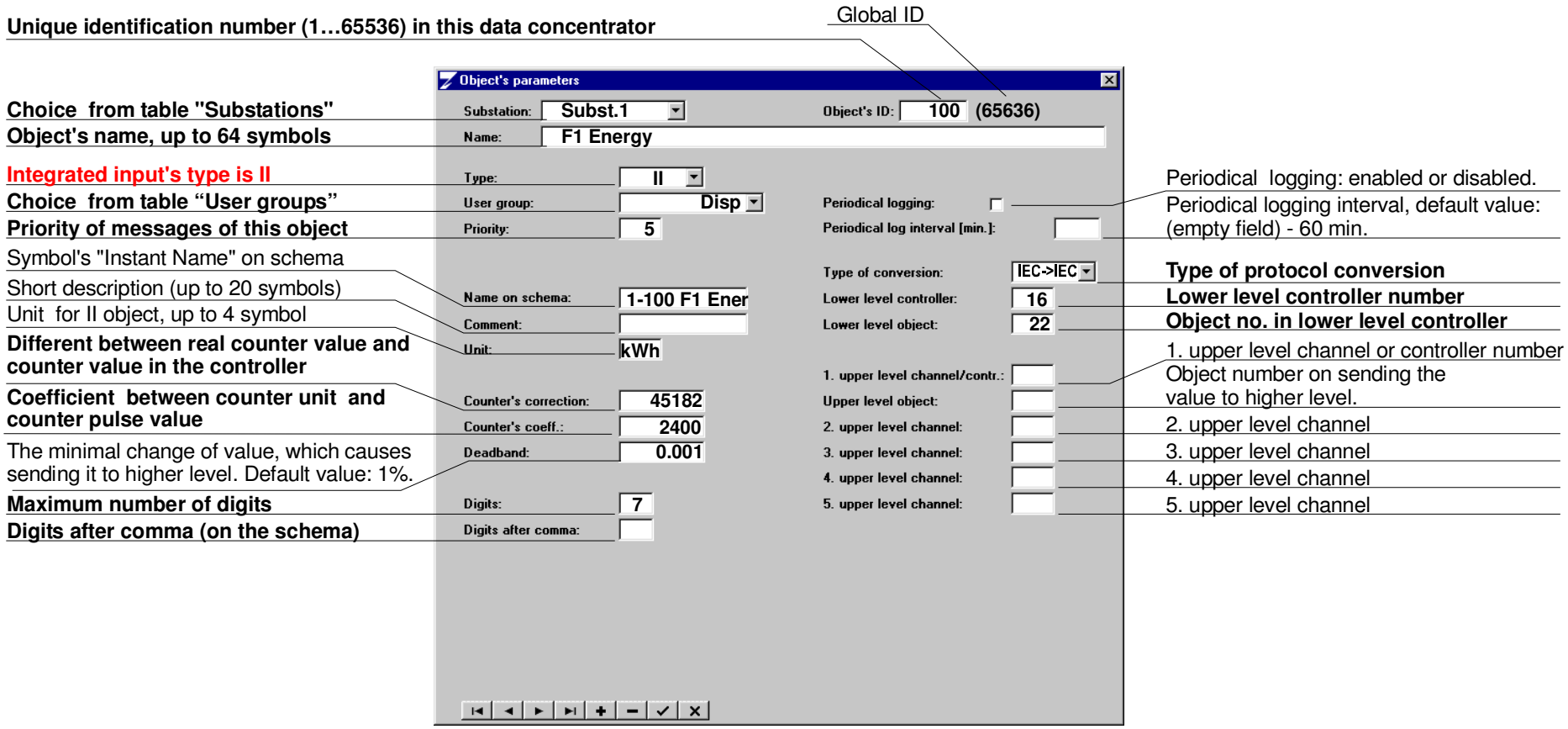
3. upper level channel

4. upper level channel

5. upper level channel

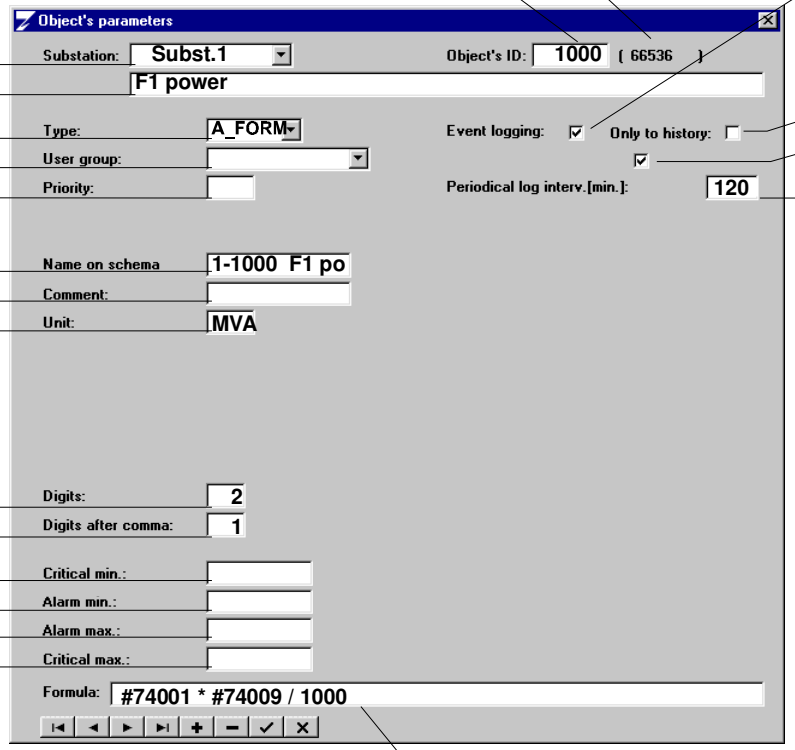
6.8.2.5 SETTING UP 'II'

Fields description, must be filled or checked, is in **bold.**



6.8.2.6 SETTING UP 'A_FROM'

Analog formula record is similar to AI-object record, corresponding fields on form must be filled like for AI-objects.
Fields description, must be filled or checked, is in **bold.**



Unique identification number (1…65536) in this data concentrator

Global ID

Event logging: enabled or disabled.

Only to history: enabled - messages will be sent only to "History" table, disabled - to "History" and "Events" tables.
Remark: if event logging is disabled, this checkbox status has no meaning.

Choice from table "Substations"

Object's name, up to 64 symbols

Analog formula's type is A_FORM

Choice from table "User groups"

Priority of messages of this object

Periodical logging: enabled or disabled.

Periodical logging interval, default value: (empty field) - 60 min.

Symbol's "Instant Name" on schema

Short description (up to 20 symbols)

Unit for AI object, up to 4 symbol

Maximum number of digits

Digits after comma (on the schema)

Value for event "Critical minimum"

Value for event "Alarm minimum"

Value for event "Alarm maximum"

Value for event "Critical maximum"

Formula's description

Analog formula syntax.

Variables:
Analog input object (AI) or other analog formula (A_FORM), performed as global identification number, added to symbol #.

Constants:
Number without additional symbol # is used as constant.

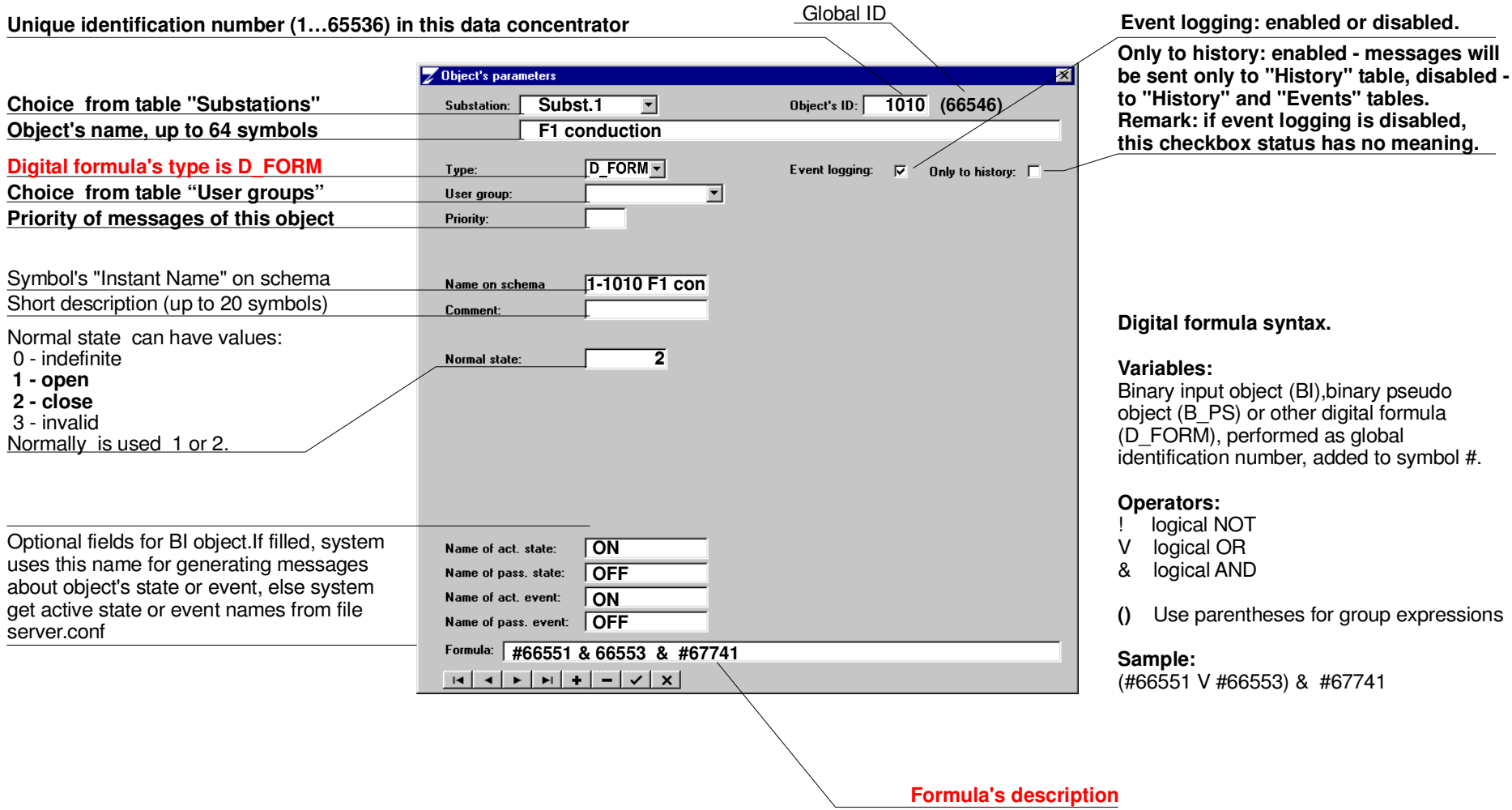
Operators:
+ add
- subtract
***** multiply
/ divide

() Use parentheses for group expressions

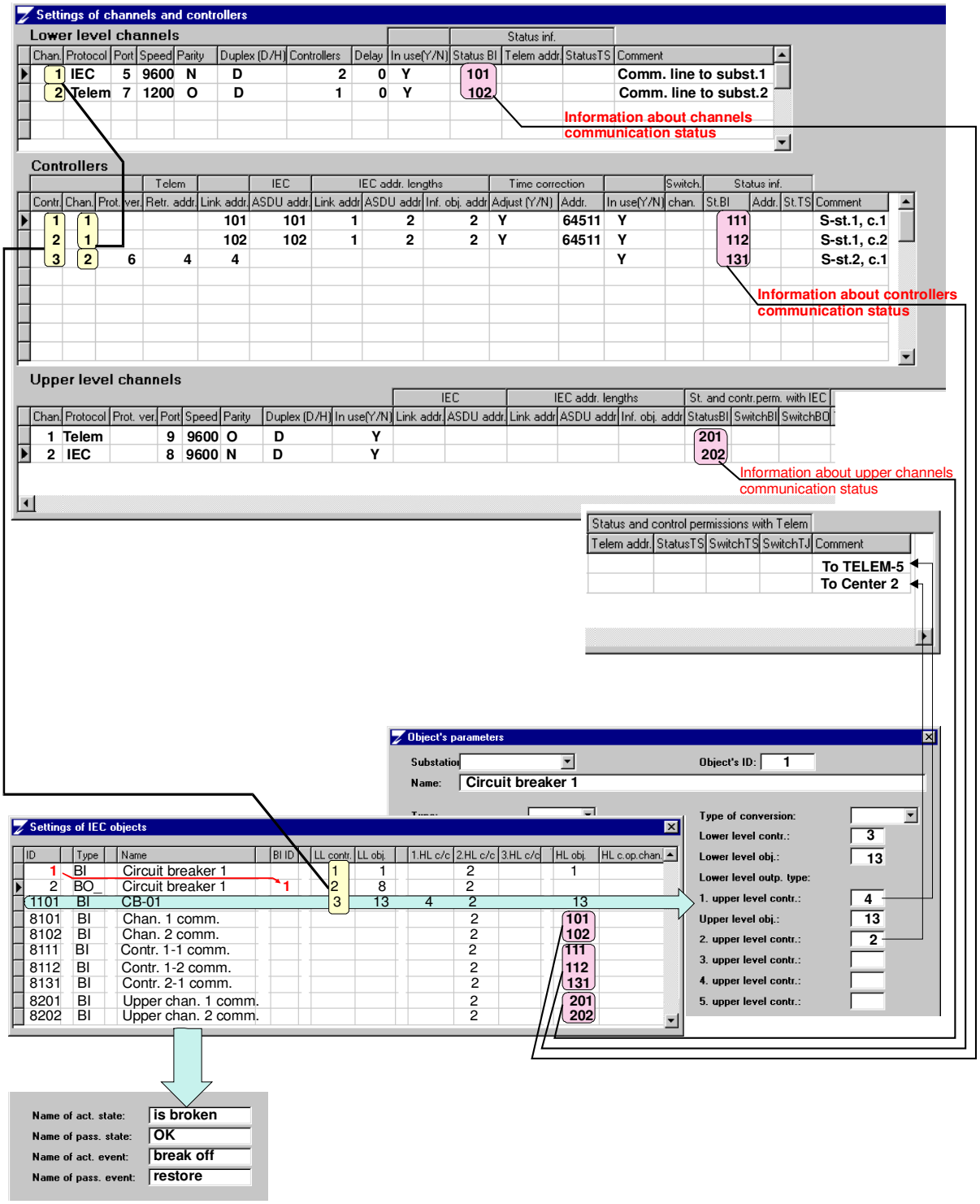
Sample:
(#74221 + #74120) * 1000 + 1200

6.8.2.7 SETTING UP 'D_FORM'

Fields description, must be filled or checked, is in **bold.**



6.9 BINDINGS BETWEEN CHANNELS, CONTROLERS AND OBJECTS



6.10 INFORMATION ROUTE FROM CONTROLLER TO SCADA SCHEMATIC