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ELCOM-90 Application programming interface specification

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RESULT (summary)

This document is one of a series of technical reports which form the complete ELCOM-90 documentation. This is version .03 of the report with minor changes regarding responsible people and references. Future updates and new versions will NOT be published for this reason. New versions will only be submitted when technical changes are made.

Please see SINTEFs homepage at: http://www.sintef.no/ELCOM-90. From here you can download the latest version of all relevant documents as pdf-files for free.

This report describes the interface between the users (application process) and the application layer of the ELCOM data communication concept. The services provided are described in Technical Report 3702.02: "ELCOM-90. Application Service Element. Service Definition".

KEYWORDS

SELECTED BY AUTHOR(S)		
	Data communication	Control centres
	Communication protocols	Energy management

SUMMARY

The ELCOM communication concept is a result of a joint project initiated by SINTEF Energy Research, former EFI (Norwegian Electric Power Research Institute). The impetus for the development was the need to exchange information in a hierarchical process control system which consisted of both hardware (computers) and software from different manufacturers.

The ISO Open Systems Interconnection Reference Model forms the basis for the ELCOM protocols.

The services provided by the application layer of ELCOM are designed to satisfy the requirements of communications:

- between computers running different Power Application Software (i.e. SCADA, EMS, planning, power market) within a power utility
- between computers running PAS between different power utilities
- between control systems at different levels.

The following set of facilities define basic ELCOM services:

- **The association establishment facility:**

Used to establish connections for information transfer.

- **The association termination facility:**

Used to release connections.

- **The group facility:**

Used for defining, changing, deleting and inspecting group of information. A group of information objects can be identified by its type and number. The group definition is agreed upon by sender and receiver and stored until changed. Thus transfer overhead is minimised.

- **The information transfer facility:**

Used for request and response to initiations of data transfer and to confirm the reception of data. Interutility real-time data transfer spontaneous data management is included. This facility also provides:

  - The command transfer service, used to transfer SCADA control commands or set-points to be executed by the SCADA system at the partner's side.
  - The mixed data transfer service, used to transfer real-time data. Data can be of any legal type and from any group.

- **The test association facility:**

Used to test that the other part is "alive" and may be reached on a specified connection.

Specific power system oriented protocols are defined for Application and Presentation Layer.

Together with the ELCOM protocol a library of routines accessible from a high level programming language (e.g. FORTRAN) is available. These routines offer access to all the basic facilities defined as ELCOM-90 services. This report describes the routines in the library.

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1 INTRODUCTION

A set of services has been added to the ELCOM-83 protocol to form the ELCOM-90 protocol. The services added are:

- ELCOM-90 - ELCOM-83 compatibility.
- Command and setpoint transmission.
- Initiator control of cycle times. Priority class.
- Version control of group definitions.
- Formats for logical breakers.
- Mixed data transfer format.
- Improvement of security.
- Short text messages.

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2 ASSOCIATED DOCUMENTS

2.1 ELCOM-83 documentation

[1]: TR 3522: **ELCOM-83 Application Service Definition**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1988-07-05

[2]: TR 3528: **ELCOM-83 Application Protocol Definition**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1988-07-14

[3]: TR 3523: **ELCOM-83 Definition of Local Application Interface**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1988-07-05

[4]: TR 3524: **ELCOM-83 Presentation Service Definition**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1988-07-06

[5]: TR 3527: **ELCOM-83 Presentation Protocol Definition**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1988-07-13

[6]: TR 3532: **ELCOM-83 Definition of Local Presentation Interface**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1988-09-12

[7]: TR 3649: **ELCOM-83 Conventions**
Norwegian Electric Power Research Institute, Trondheim, Norway, 1989-12-20
ISBN 82-594-0086-3

2.2 ELCOM-90 documentation

This document is one of a series of technical reports which form the complete ELCOM-90 documentation. Below you will find the numbers and titles for all the associated technical reports. New versions may be submitted when technical changes are made.
Please see SINTEF's homepage at: http://www.sintef.no//ELCOM-90. From here you can download the latest version of all relevant documents as pdf-files for free.

[8]: TR 3701: **ELCOM-90 Application Programming Interface Specification**

[9]: TR 3702: **ELCOM-90 Application Service Element. Service Definition**

[10]: TR 3703: **ELCOM-90 Application Service Element. Protocol Specification**

[11]: TR 3704: **ELCOM-90 Presentation Programming Interface Specification**

[12]: TR 3705: **ELCOM-90 Presentation Service Definition**

[13]: TR 3706: **ELCOM-90 Presentation Protocol Specification**

[14]: TR 3825: **ELCOM-90 User Element Conventions**

[15]: TR A3933: **ELCOM-90 Local Conventions**

[16] TR A4687: **PONG. The ELCOM net-watch procedure for TCP/IP networks**

[17] TR A4124: **ELCOM-90 Application Service Element, User's manual.**

[18] TR A6196: **Securing ELCOM-90 with TLS.**

3 DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

Object	A physical or logical data source or data sink. A specific type of data is attached to the object. This data may be time dependent. Sensors and breakers are typical objects in this context.
Group	Set of named data objects of same type, implicitly numbered by their indexes.
Group type	Describes type of objects represented in the group. The numbers below 100 are reserved for pre-defined types. The current version of ELCOM has eight predefined types of data. The type numbers from 100 and above are reserved for regional conventions.
Measure group	Group containing measured values (32 bit real).
Status group	Group containing status values (2 bit).
Discrete group	Group containing discrete values (16 bit integer).
Logical breaker status group	Group containing status information regarding busbar connection of a feeder and of connection between busbars. Normally the values are calculated locally from the breaker's status values (8 bits).
Binary command group	Group containing on/off information. This information may be used to control a breaker to the wanted state (8 bits, 2 bits used for on/off information).
Analogue setpoint group	Group containing analogue setpoint values. They are typically used as an input parameter for a regulator (32 bits real).
Digital setpoint group	Group containing digital setpoint values. They are typically used as an input parameter for a regulator (16 bits integer).
Text message group	Group containing text message strings (8 bits ASCII coded characters).
Group incarnation	Set of simultaneous values from a given group.
Group number	Identifier for a group.
Group size	Maximum number of objects in one group.
Global Conventions	ELCOM-90 Conventions [14].
Local Conventions	Regional Conventions (e.g. defining user defined group types).

Initiator The service user responsible for association establishment/group configuration, data transfer, and association termination (e.g. on a background computer as data sink).

Responder The peer service user to the initiator (e.g. on a process computer as data source responding to the requests from the initiator). A Service user may act as initiator and responder at the same time.

3.2 Abbreviations

AC : Application Connection (association)
AS : Application Service
ESAP : ELCOM Service Access Point
P-ACEP: Provider identifier for Application Connection End-Point (ACEP)
U-ACEP: User identification of ACEP
Gnr : Group number
Gtype : Group type indicator
Gsize : Group size
CF : Control field
A - : Application -
Conf : Confirm
Mgnt : Management
Spont : Spontaneous (unsolicited)

4 OVERVIEW OF INTERACTIONS

4.1 Procedure Names

PROCEDURE	FULL NAME OF PRIMITIVE	USE
AINIT	A-Init	Local
AATT	A-Attach	Local
ADET	A-Detach	Local
ACONRQ	A-Connect request	Send
ACONI	A-Connect indication	Receive
ACONRS	A-Connect response	Send
ACONC	A-Connect confirmation	Receive
ARELRQ	A-Release request	Send
ARELI	A-Release indication	Receive
ARELRS	A-Release response	Send
ARELC	A-Release confirmation	Receive
APABT	A-Provider-Abort indication	Receive
AGMRQ	A-Group-Mgnt request	Send
AGMI	A-Group-Mgnt indication	Receive
AGMRS	A-Group-Mgnt response	Send
AGMC	A-Group-Mgnt confirmation	Receive
ADGRQ	A-Def-Group request	Send
ADGI	A-Def-Group indication	Receive
ADGRS	A-Def-Group response	Send
ADGC	A-Def-Group confirmation	Receive
AGGRQ	A-Get-Group request	Send
AGGI	A-Get-Group indication	Receive
AGGRS	A-Get-Group response	Send
AGGC	A-Get-Group confirmation	Receive
AITRQ	A-Init-Transfer request	Send
AITI	A-Init-Transfer indication	Receive
ADTRQ	A-Data request	Send
ADTI	A-Data indication	Receive
ACDRQ	A-Conf-Data request	Send
ACDI	A-Conf-Data indication	Receive
ASMRQ	A-Spont-Mgnt request	Send
ASMI	A-Spont-Mgnt indication	Receive
ASMRS	A-Spont-Mgnt response	Send
ASMC	A-Spont-Mgnt confirmation	Receive

Procedure names continued

PROCEDURE	FULL NAME OF PRIMITIVE	USE
ACTRQ	A-Command-Transfer request	Send
ACTI	A-Command-Transfer indication	Receive
ACTRS	A-Command-Transfer response	Send
ACTC	A-Command-Transfer confirmation	Receive
AMDRQ	A-Mixed-Data request	Send
AMDI	A-Mixed-Data indication	Receive
AMDERQ	A-Mixed-Data-Error request	Send
AMDEI	A-Mixed-Data-Error indication	Receive
ATCRQ	A-Test-Connection request	Send
ATCI	A-Test-Connection indication	Receive
ATCRS	A-Test-Connection response	Send
ATCC	A-Test-Connection confirmation	Receive
ASWAIT	A-Special-Wait	Local
AGWAIT	A-General Wait	Local

4.2 Implementation Considerations

Interactions between the AS user and the AS provider are initiated by the AS user by issuing AS interface procedure calls.

4.3 Procedure Call Sequences

The possible sequences of successful AS interface procedure calls in the information transfer phase, for a particular group, is as defined for the service primitive corresponding to the actual procedure call.

5 SPECIFICATION OF SERVICE INTERFACE PROCEDURES

In the procedure call specification, output arguments are underlined while input arguments are not.

The structure and mode used for parameter passing shall comply with the definition given for the actual programming language.

The procedure calls shall perform a check on legal parameter values. The limits are described for each procedure call.

The procedure calls returns a Status value. An implementation may return additional Status values.

5.1 Initialisation

Function:
Initialises the application service provider. This procedure may not be available in every ELCOM-90 implementation. In such case the function is a supervisory function.

Procedure call and arguments:

AINIT **Status**.

Status Integer. Status on return.
+1 - Provider initialised.
-3 - Provider out of operation.

5.2 Attachment and detachment procedures

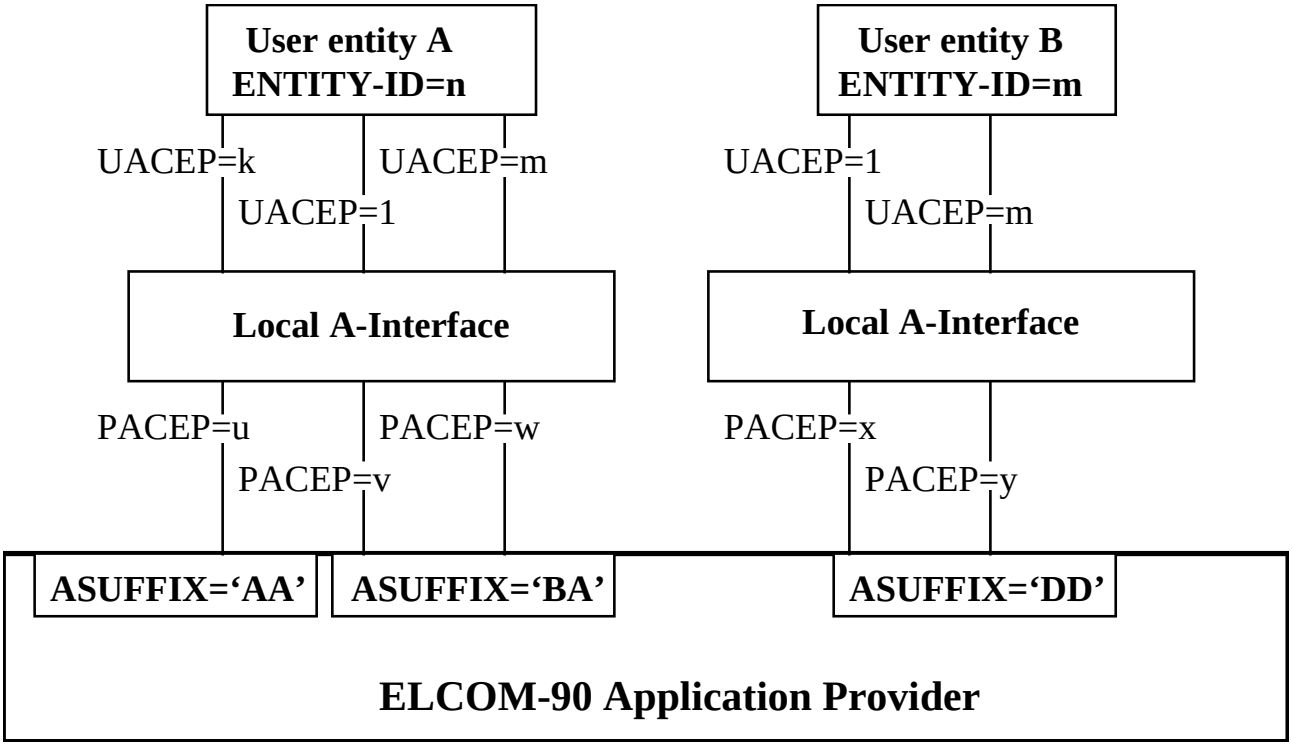
5.2.1 AATT

Function:
Several user entities may use the ELCOM-90 Application Provider simultaneously. The user entities must be identified by unique entity-id's.

A user entity is locally bound to the Application Provider using the AATT procedure call. This may be performed several times using the same or different A-suffices, thus making several bindings to the Application Provider. These bindings must be identified using unique U-ACEP's.

Two user entities are not allowed to use a given A-suffix simultaneously. The maximum number of locally bindings is implementation dependent.

Example:



Procedure call and arguments:

AATT	Entity-id, A-suffix, U-ACEP, Type, **Status**, **P-ACEP**
Entity-id	Integer. Unique identification of the user entity. (Only one entity is allowed to access the service access point at a time.)
A-suffix	2 octets. A-suffix part of the local ESAP-address. The ESAP-address consists of the lower level address followed by the A-suffix.
U-ACEP	Integer. The user's identification of the ACEP. U-ACEP is used as output argument in calls to AGWAIT.
Type	Integer. Type of ACEP. 0 - Connectionless transfer. (For future use.) 1 - Connection-oriented transfer. Local AS-user will use this ACEP as a calling AS-user. 2 - Connection-oriented transfer. Local AS-user will use this ACEP as a called AS-user (listener).
Status	Integer. Status on return. +1 - ACEP attached to user. -1 - ACEP not available. -2 - Illegal argument. -3 - AS-provider out of operation. -4 - Illegal use.
P-ACEP	Integer. The provider's identification of the ACEP. P-ACEP is used as input argument in subsequent procedure calls involving the same ACEP.

5.2.2 ADET

Function

The ADET procedure releases an association between an AS user and the AS provider.

Procedure call and arguments:

ADET	Entity-id, P-ACEP, **Status**.
Entity-id	Integer. Unique identification of the user entity.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - ACEP detached. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.

5.3 Connection Establishment Procedures

5.3.1 ACONRQ

Function

The ACONRQ interface procedure requests the AS provider to establish an AC.

Procedure call and arguments:

ACONRQ	P-ACEP, Version, Initiator, Acceptor, User-data, Length, **Status**.
P-ACEP	Integer. ACEP identifier.
Version	Integer. Version indicator. 0 (binary: 00 000 000) - Class 0, version 0 implemented. 1 (binary: 00 000 001) " 1, " 0 " 2 (binary: 00 000 010) " 2, " 0 " 18 (binary: 00 010 010) " 2, " 1 " 19 (binary: 00 010 011) " 3, " 1 "
Initiator	Address of initiator 1 octet = x Number of octets in the lower level part of the address (Network protocol dependent, see [14]). x octets The lower level part. 1 octet = y Number of octets in the A suffix (max 2) y octets The A suffix.
Acceptor	Address of acceptor coded in the same format as the Initiator address.
User-data	Data transferred transparently to the called AS user. (See [14]).
Length	Integer. Number of octets of user data (max 80).
Status	Integer. Status on return. +1 - Call accepted. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.

5.3.2 ACONI

Function

The ACONI interface procedure is used by a called AS user to receive an indication of an AC establishment initiated by a calling AS user.

Procedure call and arguments:

ACONI	P-ACEP, **Status**, **Version**, **Initiator**, **Acceptor**, **User-data**, **Length**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - Connection establishment indication not received. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.
Version	Integer. Version indicator. Data is as for ACONRQ.
Initiator	Address of calling AS user. Data is as for ACONRQ.
Acceptor	Address of called AS user. Data is as for ACONRQ.
User-data	Data transferred transparently from the calling AS user. Data is as for ACONRQ.
Length	Integer. Number of octets in user data (max 80).

5.3.3 ACONRS

Function

The ACONRS interface procedure is used by a called AS user who has received an indication of an AC and shall accept or refuse the AC establishment.

Procedure call and arguments:

ACONRS	P-ACEP, Version, Initiator, Acceptor, Result, User-data, Length, **Status**.
P-ACEP	Integer. ACEP identifier.
Version	Integer. Version indicator. 0 (binary: 00 000 000) - Class 0, version 0 implemented. 1 (binary: 00 000 001) " 1, " 0 " 2 (binary: 00 000 010) " 2, " 0 " 18 (binary: 00 010 010) " 2, " 1 " 19 (binary: 00 010 011) " 3, " 1 "
Initiator	Address of calling AS user. The format is as for the address in ACONRQ.
Acceptor	Address of called AS user coded in the same format as in ACONRQ.
Result	Integer. (See 5.11). Result ok (call accepted). Incompatible versions. Security is not supported by A service user. Incompatible security options requested. Authentication failure.
User-data	Data transparently transferred to the calling AS user (see [14]).
Length	Integer. Number of octets in user data (max 79).
Status	Integer. Status on return. +1 - Call accepted (locally). -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.

5.3.4 ACONC

Function

The ACONC interface procedure is used by the calling AS user to receive a confirmation of an AC establishment.

Procedure call and arguments:

ACONC	P-ACEP, **Status**, **Version**, **Initiator**, **Acceptor**, **Result**, **User-data**, **Length**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - Connection establishment confirmation not received. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.
Version	Integer. Version indicator. Data is as for ACONRS.
Initiator	Address of calling AS user. Data is as for ACONRS.
Acceptor	Address of called AS user. Data is as for ACONRS.

Result	Integer. (See 5.11) Result ok. Local lack of recourses. Remote lack of recourses. No answer from remote system. Remote service user unavailable. Called user unknown. Misbehaviour of locale service user. Misbehaviour of remote service user. Misbehaviour of local part of provider. Misbehaviour of remote part of provider. Incompatible versions. Security is not supported by A service user. Incompatible security options requested. Authentication failure. No available lower level connection. System implementation dependent reason. Unknown reason.
User-data	Data transparently transferred to the calling AS user. Data is as for ACONRS.
Length	Integer. Number of octets of user data (max 79).

5.4 Connection Termination Procedures

5.4.1 ARELRQ

Function

The ARELRQ interface procedure is used by an AS user to initiate the termination of an established AC.

The ARELRQ interface procedure call may be issued by one of the AS users for an established AC.

Procedure call and arguments:

ARELRQ	P-ACEP, User-reason, **Status**.
P-ACEP	Integer. ACEP identifier
User-reason	1 octet. Code specifying user's reason for initiating a disconnection. Transferred transparently to the remote AS user. 18 - Invalid Message Authentication Code received. 19 - Decipherment error.
Status	Integer. Status on return. +1 - Call accepted. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use. -5 - A-Release indication received.

5.4.2 ARELI

Function

The ARELI interface procedure is used by an AS user to receive an indication of an AC release which is initiated by the other AS user during data transfer.

Procedure call and arguments:

ARELI	P-ACEP, **Status**, **User-reason**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - Release indication not received. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.
User-reason	1 octet. Code specifying user's reason for initiating a disconnection. Transferred transparently to the remote AS user. Data is as for ARELRQ.

5.4.3 ARELRS

Function

The ARELRS interface procedure is used by an AS user to initiate a response to a received release indication.

Procedure call and arguments:

ARELRS	P-ACEP, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Result	Integer. (See 5.11). Result ok. Collision. (Release initiated simultaneously by the local and remote AS users.)
Status	Integer. Status on return. +1 - Call accepted. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.

5.4.4 ARELC

Function

The ARELC interface procedure is used by the initiator of the release to receive a release confirmation.

Procedure call and arguments:

ARELC	P-ACEP, **Status**, **Result**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - Release confirmation not received. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.
Result	Integer. (See 5.11). Result as in ARELRS.

5.4.5 APABT

Function

The APABT interface procedure is used by an AS user to receive a provider initiated abort indication.

Procedure call and arguments:

APABT	P-ACEP, **Status**, **Reason**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - Provider abort not received. -2 - Illegal argument. -3 - AS provider out of operation. -4 - Illegal use.
Reason	Integer. Reason for aborting the connection (See 5.11). Quality of service below minimum level. No answer from remote system. Misbehaviour of local service user. Misbehaviour of remote service user. Misbehaviour of local part of provider. Misbehaviour of remote part of provider. No available lower level connection. System implementation dependent reason. Unknown reason.

5.5 Group Management

5.5.1 AGMRQ

Function

The AGMRQ procedure is used to transfer a request for group management to the remote AS user.

Procedure calls and arguments

AGMRQ	P-ACEP, Function, Gtype, Gnr, Gsize, Objlength, Persist, Static, Priorityclass, **Status**.
P-ACEP	Integer. ACEP identifier.
Function	Integer. Function key. +1 - G-Create. +2 - G-Change. +3 - G-Delete. +4 - Delete all groups belonging to a system. A system is identified by its lower level address.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +5 - Binary command group. +6 - Analogue setpoint group. +7 - Digital setpoint group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Gsize	Integer. Maximum number of objects in group. 0 <= value <= 255 This may put limitations to the value range of the parameters index1 and index2 described below. For locally defined groups (predefined), the size of index1 and index2 may be larger than 255.
Objlength	Integer. Maximum number of octets in object identifier. 0 <= value <= 255
Persist	Boolean. Deletability indicator.

Static	Boolean. Redefineability indicator.
Priorityclass	Integer. Priority Class value. 0 <= value <= 15
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.5.2 AGMI

Function

The AGMI procedure call is used to receive a group management indication coming from the remote AS user.

Procedure call and arguments

AGMI	P-ACEP, **Status**, **Function**, **Gtype**, **Gnr**, **Gsize**, **Objlength**, **Persist**, **Static**, **Priorityclass**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Group-Mgnt not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Function	Integer. Function key. Data is as for AGMRQ.
Gtype	Integer. Group type indicator. Data is as for AGMRQ.
Gnr	Integer. Group number. Data is as for AGMRQ.
Gsize	Integer. Maximum number of objects in group. Data is as for AGMRQ.
Objlength	Integer. Maximum number of octets in object identifier. Data is as for AGMRQ.
Persist	Boolean. Deletability indicator. Data is as for AGMRQ.
Static	Boolean. Redefineability indicator. Data is as for AGMRQ.
Priorityclass	Integer. Priority Class value. Data is as for AGMRQ.

5.5.3 AGMRS

Function

The AGMRS procedure is used to return a response on a received group management indication. The procedure returns a Control Field to support check of group consistency.

Procedure call and arguments

AGMRS P-ACEP, Function, Gtype, Gnr, CF, Result, **Status**.

P-ACEP Integer. ACEP identifier.

Function Integer. Function key.
+1 - G-Create
+2 - G-Change
+3 - G-Delete
+4 - Delete all groups belonging to a system. A system is identified by its lower level address.

Gtype Integer. Group type indicator.
0 <= value <= 255
+1 - Measure group.
+2 - Status group.
+3 - Discrete group
+4 - Logical breaker status group.
+5 - Binary command group.
+6 - Analogue setpoint group.
+7 - Digital setpoint group.
+8 - Text message group.

Gnr Integer. Group number.
0 <= value <= 32767

CF Integer array (9).
Control Field for group configuration consistency check. CF (1-7) is used to transfer the time when the configuration was accepted and stored in the responding system.
CF(1) = Year - 1900 0 <= value <= 254
CF(2) = Month 1 <= value <= 12
CF(3) = Day 1 <= value <= 31
CF(4) = Hour 0 <= value <= 24
CF(5) = Minute 0 <= value <= 59
CF(6) = Second 0 <= value <= 59
CF(7) = Millisec. 0 <= value <= 999
CF(8-9) is used by responder for result of checksum calculations on the internal group configuration data structures. Format and methods are implementation dependant. If Result ≠ 0 then CF is invalid.

Result	Integer. (See 5.11). Result ok. Gtype out of range. Gnr out of range. Gsize out of range. Objlength out of range. No memory. Group exists. Not deleteable. Remote service user unavailable. Priority class out of range.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.5.4 AGMC

Function

The AGMC procedure is used to receive a confirmation on a transmitted group management request. The procedure returns a Control Field to support check of group consistency.

Procedure call and arguments

AGMC	P-ACEP, **Status**, **Function**, **Gtype**, **Gnr**, **CF**, **Result**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. PCEP identifier. +1 - Call accepted. 0 - A-Group-Mgnt not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Function	Integer. Function key. Data is as for AGMRS.
Gtype	Integer. Group type indicator. Data is as for AGMRS
Gnr	Integer. Group number. Data is as for AGMRS.
CF	Integer array. Data is as for AGMRS
Result	Integer. (See 5.11). Result ok. Gtype out of range. Gnr out of range. Gsize out of range. Objlength out of range. No memory. Group exists. Not deleteable. No answer from remote part of provider. Remote service user unavailable. Misbehaviour of remote service user. Misbehaviour of remote part of provider. Priority class out of range.

5.6 Group Definition

5.6.1 ADGRQ

Function

The ADGRQ procedure call is used to transfer a group definition request to the remote AS user. It may be necessary to call the procedure several times to define an entire group by defining subgroups.

Procedure call and arguments

ADGRQ	P-ACEP, Gtype, Gnr, Index1, Index2, Objid, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +5 - Binary command group. +6 - Analogue setpoint group. +7 - Digital setpoint group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Index1	Integer. Starting index in the subgroup. 0 <= value <= 32767
Index2	Integer. Ending index in the subgroup. 0 <= value <= 32767
Objid	Octets. Object identifiers. 1 octet=X Number of ASCII characters in the immediately following identifier. X octets Object identifier. This sequence shall be repeated for each object. X = 0 terminates the octet string (One object of zero length).
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.6.2 ADGI

Function

The ADGI procedure call is used to receive a group definition indication from the remote AS user.

Procedure call and arguments

ADGI	P-ACEP, Size, **Status**, **Gtype**, **Gnr**, **Index1**, **Index2**, **Objid**.
P-ACEP	Integer. ACEP identifier.
Size	Integer. Maximum number of octets that may be received in Objid. (When Size is less than required, the call is returned with Status = -2.)
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Def-Group indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for ADGRQ.
Gnr	Integer. Group number Data is as for ADGRQ.
Index1	Integer. Starting index in the subgroup. Data is as for ADGRQ.
Index2	Integer. Ending index in the subgroup. Data is as for ADGRQ.
Objid	Octets. Object identifiers. Data is as for ADGRQ.

5.6.3 ADGRS

Function

The ADGRS procedure is used to respond to a received group definition indication. The procedure returns a Control Field to support check of group consistency.

Procedure call and arguments

ADGRS	P-ACEP, Gtype, Gnr, Index1, Index2, CF, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +5 - Binary command group. +6 - Analogue setpoint group. +7 - Digital setpoint group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Index1	Integer. Starting index in the subgroup. 0 <= value <= 32767
Index2	Integer. Ending index in the subgroup. 0 <= value <= 32767
CF	Integer array (9). Control Field for group configuration consistency check. CF (1-7) is used to transfer the time when the configuration was accepted and stored in the responding system. CF(1) = Year - 1900 0 <= value <= 254 CF(2) = Month 1 <= value <= 12 CF(3) = Day 1 <= value <= 31 CF(4) = Hour 0 <= value <= 24 CF(5) = Minute 0 <= value <= 59 CF(6) = Second 0 <= value <= 59 CF(7) = Millisec. 0 <= value <= 999 CF(8-9) is used by responder for result of checksum calculations on the internal group configuration data structures. Format and methods are implementation dependant. If Result ≠ 0 then CF is not valid.

Result — Integer array. (See 5.11). One element for each Objid in ADGRQ. Only the first element shall be used for codes marked with an asterisk:

Result ok.
Gtype out of range.*
Gnr out of range.*
Objlength out of range.
Objid unknown.
Config buffer overflow.*
Not reconfigurable.*
Index out of range.*

The sequence is terminated by an element with value = -1.

Status — Integer. Status on return.

+1 - Call accepted.
-1 - Call not accepted due to flow control.
Call must be repeated later.
-2 - Illegal argument.
-3 - Provider out of operation.
-4 - Illegal use.

5.6.4 ADGC

Function

The ADGC procedure is used to receive a confirmation on a transmitted group definition request. The procedure returns a Control Field to support check of group consistency.

Procedure call and arguments

ADGC	P-ACEP, Size, **Status**, **Gtype**, **Gnr**, **Index1**, **Index2**, **CF**, **Result**.
P-ACEP	Integer. ACEP identifier.
Size	Integer. Maximum number of result values that may be received in Result. (When Size is less than required, the call is returned with Status = -2.)
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Def-Group confirmation not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for ADGRS.
Gnr	Integer. Group number. Data is as for ADGRS.
Index1	Integer. Starting index in the subgroup. Data is as for ADGRS.
Index2	Integer. Ending index in the subgroup. Data is as for ADGRS.
CF	Integer array. Control Field for group consistency check. Data is as for ADGRS.

Result Integer array. (See 5.11). One element for each Objid in ADGRQ. Only the first element shall be used for codes marked with an asterisk:

Result ok.
Gtype out of range.*
Gnr out of range.*
Objlength out of range.
Objid unknown.
Config buffer overflow.*
Not reconfigurable.*
No answer from remote part of provider.*
Remote service user unavailable.*
Misbehaviour of remote service user.*
Misbehaviour of remote part of provider.*
Index out of range.*

The sequence is terminated by an element with value = -1

5.7 Readout of Group Definition

5.7.1 AGGRQ

Function

The AGGRQ procedure is used to request the remote AS user for a specified group definition. It may be necessary to call the procedure several times to get an entire group by getting subgroups.

Procedure call and arguments

AGGRQ	P-ACEP, Gtype, Gnr, Index1, Index2, **Status**
P-ACEP	Integer. ACEP identifier
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +5 - Binary command group +6 - Analogue setpoint group +7 - Digital setpoint group +8 - Text message group
Gnr	Integer. Group number. 0 <= value <= 32767
Index1	Integer. Starting index in the subgroup. 0 <= value <= 32767
Index2	Integer. Ending index in the subgroup. 0 <= value <= 32767
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.7.2 AGGI

Function

The AGGI procedure is used to receive an indication on a request from the remote AS user for a group definition readout.

Procedure call and arguments

AGGI	P-ACEP, **Status**, **Gtype**, **Gnr**, **Index1**, **Index2**
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Get-Group indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for AGGRQ.
Gnr	Integer. Group number. Data is as for AGGRQ.
Index1	Integer. Starting index in the subgroup. Data is as for AGGRQ.
Index2	Integer. Ending index in the subgroup. Data is as for AGGRQ.

5.7.3 AGGRS

Function

The AGGRS procedure is used to return a readout of requested group definition.

Procedure call and arguments

AGGRS	P-ACEP, Gtype, Gnr, Persist, Static, Priorityclass, Gsize, Index1, Index2, Objlength, Objid, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +5 - Binary command group. +6 - Analogue setpoint group. +7 - Digital setpoint group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Persist	Boolean. Deleteability indicator.
Static	Boolean. Redefineability indicator.
Priorityclass	Integer. Priority class value. 0 <= value <= 15.
Gsize	Integer. Group size. 0 <= value <= 255.
Index1	Integer. Starting index in the subgroup. 0 <= value <= 32767.
Index2	Integer. Ending index in the subgroup. 0 <= value <= 32767.
Objlength	Integer. Max length of object identifier in octets. 0 <= value <= 255.
Objid	Octets. Object identifiers. Syntax as for ADGRQ procedure.

Result	Integer. (See 5.11). Result ok. Gtype out of range. Gnr out of range. Remote service user unavailable. Index out of range.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.7.4 AGGC

Function

The AGGC procedure is used to receive a requested group definition readout.

Procedure call and arguments

AGGC	P-ACEP, Size, **Status**, **Gtype**, **Gnr**, **Persist**, **Static**, **Priorityclass**, **Gsize**, **Index1**, **Index2**, **Objlength**, **Objid**, **Result**.
P-ACEP	Integer. ACEP identifier
Size	Integer. Maximum number of octets that may be received in Objid. (When size is less than required, the call is returned with Status = -2.)
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Get-Group confirmation not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for AGGRS.
Gnr	Integer. Group number. Data is as for AGGRS.
Persist	Boolean. Deleteability indicator. Data is as for AGGRS.
Static	Boolean. Redefineability indicator. Data is as for AGGRS.
Priorityclass	Integer. Priority class value. Data is as for AGGRS.
Gsize	Integer. Group size. Data is as for AGGRS.
Index1	Integer. Starting index in the subgroup. Data is as for AGGRS.
Index2	Integer. Ending index in the subgroup. Data is as for AGGRS.

Objlength Integer. Max length of object identifier in octets.
Data is as for AGGRS.

Objid Octets. Object identifiers.
Data is as for AGGRS.

Result Integer. (See 5.11).
Result ok.
Gtype out of range.
Gnr out of range.
No answer from remote part of provider.
Remote service user unavailable.
Misbehaviour of remote service user.
Misbehaviour of remote part of provider.
Index out of range.

5.8 Information Transfer

5.8.1 AITRQ

Function

The AITRQ procedure is used to request the remote AS user for information from a (sub)group.

Procedure call and arguments

AITRQ	P-ACEP, Gtype, Gnr, Index1, Index2, TO, Dt, T-Unit, Periods, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Index1	Integer. Starting object index. 0 <= value <= 32767 The first index in a group is number 1.
Index2	Integer. Ending object index. 0 <= value <= 32767 (Index1 = Index2 = 0 is equivalent to requesting the complete group.)
TO	Integer array. Point of time for oldest requested group incarnation. TO(1) = Year - 1900 0 <= value <= 254, or value = -1 TO(2) = Month 1 <= value <= 12 TO(3) = Day. 1 <= value <= 31 TO(4) = Hour 0 <= value <= 24 TO(5) = Minute 0 <= value <= 59 TO(6) = Second 0 <= value <= 59 TO(7) = Millisecond. 0 <= value <= 999 TO(1) = -1 implies latest incarnation of the group. Dt, T-unit and Periods are then redundant and shall not be regarded.
Dt	Integer. Time-slice between two consecutive group incarnations. 1 <= value <= 255.

T-Unit	Integer. Unit for Dt. +1 - Year. +2 - Month. +3 - Day. +4 - Hour. +5 - Minute. +6 - Second. +7 - Millisecond.
Periods	Integer. Number of group incarnations requested. 0 <= value <= 32767. Periods = 0 means 1 group incarnation. Periods = 1 means 1 group incarnation.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. -2 - Illegal argument. -3 - Provider out of operation.

Remark: If Gtype = 8 then TO, Dt, T-unit and Periods should be dummy, and the following parameters should be regulated by global or local conventions: Gnr, Index1, Index2

5.8.2 AITI

Function

The AITI procedure is used to receive an Init transfer indication.

Procedure call and arguments

AITI	P-ACEP, **Status**, **Gtype**, **Gnr**, **Index1**, **Index2**, **TO**, **Dt**, **T-Unit**, **Periods**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Init-Transfer indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for AITRQ.
Gnr	Integer. Group number. Data is as for AITRQ.
Index1	Integer. Starting object index. Data is as for AITRQ.
Index2	Integer. Ending object index. Data is as for AITRQ.
TO	Integer array. Point of time for oldest requested group incarnation. Data is as for AITRQ.
Dt	Integer. Time-slice between two consecutive group incarnations. Data is as for AITRQ.
T-Unit	Integer. Unit for Dt. Data is as for AITRQ.
Periods	Integer. Number of group incarnations requested. Data is as for AITRQ.

Remark: If Gtype = 8 then TO, Dt, T-unit and Periods should be dummy, and the following parameters should be regulated by global or local conventions: Gnr, Index1, Index2

5.8.3 ADTRQ

Function

The ADTRQ procedure call is used to transfer one group of information from a (sub)group to the remote AS user or to indicate an erroneous initiation of data transfer.

Procedure call and arguments

ADTRQ	P-ACEP, Gtype, Gnr, Transmod, Index1, Index2, T, More-D, Data, Length, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Transmod	Integer. +1 - Initiated. +2 - Spontaneous.
Index1	Integer. Starting object index. 0 <= value <= 32767
Index2	Integer. Ending object index. 0 <= value <= 32767
T	Integer array. Point of time when values were measured. T(1) = Year - 1900 0 <= value <= 254 T(2) = Month 1 <= value <= 12 T(3) = Day. 1 <= value <= 31 T(4) = Hour 0 <= value <= 24 T(5) = Minute 0 <= value <= 59 T(6) = Second 0 <= value <= 59 T(7) = Millisecond. 0 <= value <= 999
More-D	Boolean. More data to follow indicator.
Data	Octets. (Data format is described in [14.) (Max 236 octets)
Length	Integer. Length of Data in octets.

Result	Integer. (See 5.11). Result ok. Gtype out of range. Gnr out of range. Index out of range. TO out of range. DT out of range. Remote service user unavailable.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

Remark: If Gtype = 8 then the use of the following parameters are regulated by global or local conventions: Gnr, Index1, Index2

5.8.4 ADTI

Function

The ADTI procedure call is used to receive information from a (sub)group or an error indication from the remote AS user.

Procedure call and arguments

ADTI	P-ACEP, Size, **Status**, **Gtype**, **Gnr**, **Transmod**, **Index1**, **Index2**, **T**, **More-D**, **Data**, **Length**, **Result**.
P-ACEP	Integer. ACEP identifier.
Size	Integer. Maximum number of octets that may be received in Data. (When size is less than required, the call is returned with status = -2.)
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Send-Data indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for ADTRQ.
Gnr	Integer. Group number. Data is as for ADTRQ.
Transmod	Integer. Data is as for ADTRQ.
Index1	Integer. Starting object index. Data is as for ADTRQ.
Index2	Integer. Ending object index. Data is as for ADTRQ.
T	Integer array. Point of time when values were measured. Data is as for ADTRQ.
More-D	Boolean. More data to follow indicator. Data is as for ADTRQ.
Data	Octets. Data is as for ADTRQ.

Length Integer. Length of Data in octets.
Data is as for ADTRQ.

Result Integer. (See 5.11).
Result ok.
Gtype out of range.
Gnr out of range.
Index out of range.
TO out of range.
Dt out of range.
No answer from remote part of provider.
Remote service user unavailable.
Misbehaviour of remote service user.
Misbehaviour of remote part of provider.

Remark: If Gtype = 8 then the use of the following parameters are regulated by global or local conventions: Gnr, Index1, Index2

5.8.5 ACDRQ

Function

The ACDRQ procedure call is used to confirm the reception of the last ADTI in a sequence of ADTIs received from the remote AS user, or to report an error situation.

Procedure call and arguments

ACDRQ	P-ACEP, Gtype, Gnr, Transmod, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767.
Transmod	Integer. +1 - Initiated. +2 - Spontaneous.
Result	Integer. (See .11). Result ok. Gtype out of range. Gnr out of range. T out of range. Index out of range. Remote service user unavailable. Spontaneous transfer not initiated.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

Remark: If Gtype = 8 then the use of the parameter Gnr is regulated by global or local conventions.

5.8.6 ACDI

Function

The ACDI procedure call is used to receive a confirm data indication.

Procedure call and arguments

ACDI	P-ACEP, **Status**, **Gtype**, **Gnr**, **Transmod**, **Result**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Conf-Data indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for ACDRQ.
Gnr	Integer. Group number. Data is as for ACDRQ.
Transmod	Integer. Data is as for ACDRQ.
Result	Integer. (See 5.11). Result ok. Gtype out of range. Gnr out of range. Index out of range. T out of range. No answer from remote part of provider. Remote service user unavailable. Misbehaviour of remote service user. Misbehaviour of remote part of provider. Spontaneous transfer not initiated.

Remark: If Gtype = 8 then the use of the parameter Gnr is regulated by global or local conventions.

5.8.7 ASMRQ

Function

The ASMRQ procedure is used to request the remote AS user to start or stop spontaneous information transfer.

Procedure call and arguments

ASMRQ	P-ACEP, Function, Gtype, Gnr, **Status**.
P-ACEP	Integer. ACEP identification.
Function	Integer. +1 - Start. +2 - Stop.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

Remark: If Gtype = 8 then the use of the parameter Gnr is regulated by global or local conventions.

5.8.8 ASMI

Function

The ASMI procedure call is used to receive a spontaneous management indication.

Procedure call and arguments

ASMI	P-ACEP, **Status**, **Function**, **Gtype**, **Gnr**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Spont-Mgnt indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Function	Integer. Data is as for ASMRQ.
Gtype	Integer. Group type indicator. Data is as for ASMRQ.
Gnr	Integer. Group number. Data is as for ASMRQ.

Remark: If Gtype = 8 then the use of the parameter Gnr is regulated by global or local conventions.

5.8.9 ASMRS

Function

The ASMRS procedure call is used to respond to a received spontaneous management indication.

Procedure call and arguments

ASMRS	P-ACEP, Function, Gtype, Gnr, Result, **Status**
P-ACEP	Integer. ACEP identification
Function	Integer. +1 - Start. +2 - Stop.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +1 - Measure group. +2 - Status group. +3 - Discrete group. +4 - Logical breaker status group. +8 - Text message group.
Gnr	Integer. Group number. 0 <= value <= 32767
Result	Integer. (See 5.11). Result ok. Gtype out of range. Gnr out of range. Remote service user unavailable.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

Remark: If Gtype = 8 then the use of the parameter Gnr is regulated by global or local conventions.

5.8.10 ASMC

Function

The ASMC procedure is used to receive a spontaneous management confirmation.

Procedure call and arguments

ASMC	P-ACEP, **Status**, **Function**, **Gtype**, **Gnr**, **Result**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Spont-Mgnt confirmation not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Function	Integer. Data is as for ASMRS.
Gtype	Integer. Group type indicator. Data is as for ASMRS.
Gnr	Integer. Group number. Data is as for ASMRS.
Result	Integer. (See 5.11) Result ok. Gtype out of range. Gnr out of range. No answer from remote part of provider. Remote service user unavailable. Misbehaviour of remote service user. Misbehaviour of remote part of provider.

Remark: If Gtype = 8 then the use of the parameter Gnr is regulated by global or local conventions.

5.8.11 ACTRQ

Function

The ACTRQ procedure is used to transfer one command or setpoint data block to the remote side.

Procedure call and arguments

ACTRQ	P-ACEP, Gtype, Gnr, Index1, Index2, T, Time mode, Com.type, Data, Length, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <=255 +5 - Binary command group. +6 - Analogue setpoint group. +7 - Digital setpoint group.
Gnr	Integer. Group number. 0 <= value <= 32767.
Index1	Integer. Starting object index. 0 <= value <= 32767.
Index2	Integer. Ending object index. 0 <= value <= 32767.
T	Integer array. Point of time dependent of Time mode argument. T(1) = Year - 1900 0 <= value <= 254 T(2) = Month 1 <= value <= 12 T(3) = Day. 1 <= value <= 31 T(4) = Hour 0 <= value <= 24 T(5) = Minute 0 <= value <= 59 T(6) = Second 0 <= value <= 59 T(7) = Millisecond. 0 <= value <= 999
Time mode	Integer. Determines the interpretation of T. 0 - T argument not used. +2 - Latest point of time when command can be issued at the remote side. +3 - Point of time when command shall be issued at the remote side.

Com.type	Integer. Command type. +1 - CBXC Check before execute command. +2 - EXC Execute command. +3 - IHC Inhibit command. +252 - IXC Immediate execute.
Data	Octets. (The data format is described in [14].) (Max 236 octets.) If Com.type is CBXC, the data field may be empty.
Length	Integer. Length of Data in octets. If the command type is CBXC and the data field does not contain data, the length is 0.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.8.12 ACTI

Function

The ACTI procedure is used to receive one command or setpoint data block.

Procedure call and arguments

ACTI	P-ACEP, Size, **Status**, **Gtype**, **Gnr**, **Index1**, **Index2**, **T**, **Time mode**, **Com.type**, **Data**, **Length**.
P-ACEP	Integer. ACEP identifier.
Size	Integer. Maximum number of octets that may be received in Data. When Size is less than required, the call is returned with Status = -2.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Command-Transfer indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for ACTRQ.
Gnr	Integer. Group number. Data is as for ACTRQ.
Index1	Integer. Starting object index. Data is as for ACTRQ.
Index2	Integer. Ending object index. Data is as for ACTRQ.
T	Integer array. Point of time dependent of Time mode argument. Data is as for ACTRQ.
Time mode	Integer. Determines the interpretation of T. Data is as for ACTRQ.
Com.type	Integer. Command type. Data is as for ACTRQ.
Data	Octets. Data is as for ACTRQ.
Length	Integer. Length of Data in octets.

5.8.13 ACTRS

Function

The ACTRS procedure is used to respond to one command or setpoint data block.

Procedure call and arguments

ACTRS	P-ACEP, Gtype, Gnr, Index1, Index2, T, Time mode, Com.type, Data, Length, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Gtype	Integer. Group type indicator. 0 <= value <= 255 +5 - Binary command group. +6 - Analogue setpoint group. +7 - Digital setpoint group.
Gnr	Integer. Group number. 0 <= value <= 32767.
Index1	Integer. Starting object index. 0 <= value <= 32767.
Index2	Integer. Ending object index. 0 <= value <= 32767.
T	Integer array. Point of time dependent of Time mode argument. T(1) = Year - 1900 0 <= value <= 254 T(2) = Month 1 <= value <= 12 T(3) = Day. 1 <= value <= 31 T(4) = Hour 0 <= value <= 24 T(5) = Minute 0 <= value <= 59 T(6) = Second 0 <= value <= 59 T(7) = Millisecond. 0 <= value <= 999
Time mode	Integer. Determines the interpretation of T 0 - T argument not used. +1 - T is the time of issuance of the command at the remote side.
Com.type	Integer. Command type. +4 - CBR Check back response. +5 - EXR Execute response. +6 - IHR Inhibit response.
Data	Octets. (Data format is described in [14].) If Com.type is CBR the data field may be empty.

Length	Integer. Length of Data in octets. If the command type is CBR, and the data field does not contain data, the length is 0.
Result	Integer (see 5.11). Result ok. Gtype out of range. Gnr out of range. Index out of range. T out of range. Time mode out of range. Command type out of range. Time mode not supported by A-service user. Command type not supported by A-service user. EXC data different from CBXC data. CBXC not received before EXC. Remote service user unavailable. No answer from remote part of provider.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.8.14 ACTC

Function

The ACTC procedure is used to receive an A-Command-Transfer confirmation data block from the RTU side.

Procedure call and arguments

ACTC	P-ACEP, Size, **Status**, **Gtype**, **Gnr**, **Index1**, **Index2**, **T**, **Time mode**, **Com.type**, **Data**, **Length**, **Result**.
P-ACEP	Integer. ACEP identifier.
Size	Integer. Maximum number of octets that may be received in Data. When Size is less than required, the call is returned with Status = -2.
Status	Integer. Status on return. +1 -Call accepted. 0 - A-Command-Transfer confirmation not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gtype	Integer. Group type indicator. Data is as for ACTRS.
Gnr	Integer. Group number. Data is as for ACTRS.
Index1	Integer. Starting object index. Data is as for ACTRS.
Index2	Integer. Ending object index. Data is as for ACTRS.
T	Integer array. Point of time dependent of Time mode argument. Data is as for ACTRS.
Time mode	Integer. Determines the interpretation of T Data is as for ACTRS.
Com.type	Integer. Command type. Data is as for ACTRS.
Data	Octets. Data is as for ACTRS.

Length Integer. Length of Data in octets.
Data is as for ACTRS.

Result Integer (see 5.11).
Result ok.
Gtype out of range.
Gnr out of range.
Index out of range.
T out of range.
Time mode out of range.
Command type out of range.
Time mode not supported by A-service user.
Command type not supported by A-service user.
EXC data different from CBXC data.
CBXC not received before EXC.
Remote service user unavailable.
No answer from remote part of provider.

5.8.15 AMDRQ

Function

The AMDRQ procedure is used for spontaneous transfer of mixed data. Data from many groups are mixed, including data from different group types.

Procedure call and arguments

AMDRQ	P-ACEP, T, Data, Length, **Status**.
P-ACEP	Integer. ACEP identifier.
T	Integer array. Point of time concerning the first data element in the data field argument. T(1) = Year - 1900 0 <= value <= 254 T(2) = Month 1 <= value <= 12 T(3) = Day. 1 <= value <= 31 T(4) = Hour 0 <= value <= 24 T(5) = Minute 0 <= value <= 59 T(6) = Second 0 <= value <= 59 T(7) = Millisecond. 0 <= value <= 999
Data	Octets. (Data format is described in [14]). (Max 246 octets).
Length	Integer. Length of Data in octets.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.8.16 AMDI

Function

The AMDI procedure is used to receive mixed data from the remote AS User. Data from many groups are mixed, including data from different group types.

Procedure call and arguments

AMDI	P-ACEP, Size, **Status**, **T**, **Data**, **Length**.
P-ACEP	Integer. ACEP identifier.
Size	Integer. Maximum number of octets that may be received in Data. When Size is less than required, the call is returned with Status = -2.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Mixed-Data indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
T	Integer array. Point of time concerning the first data element in the data field argument. Data is as for AMDRQ.
Data	Octets. Data is as for AMDRQ.
Length	Integer. Length of Data in octets. Data is as for AMDRQ.

5.8.17 AMDERQ

Function

The AMDERQ procedure is used to report that an error is detected in the Data field in a received AMDI.

Procedure call and arguments

AMDERQ	P-ACEP, Gnr, Result, **Status**
P-ACEP	Integer. ACEP identifier.
Gnr	Integer. Group number. 0 <= value <= 32767.
Result	Integer (see 5.11). Spontaneous transfer not initiated. Gnr out of range. Index out of range.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.8.18 AMDEI

Function

The AMDEI procedure is used to receive an error report saying that an error is detected in the Data field of a previous transferred AMDRQ.

Procedure call and arguments

AMDERQ	P-ACEP, **Status**, **Gnr**, **Result**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. 0 - A-Mixed-Data-Error indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Gnr	Integer. Group number. Data is as for AMDRQ.
Result	Integer (see 5.11). Spontaneous transfer not initiated. Gnr out of range. Index out of range.

5.9 Test Connection

5.9.1 ATCRQ

Function

The ATCRQ procedure call shall be used to test that the remote AS user can be reached and is alive.

Procedure call and arguments

ATCRQ	P-ACEP, **Status**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.9.2 ATCI

Function

The ATCI procedure call shall be used to receive an A-Test-Connection indication.

Procedure call and parameters

ATCI	P-ACEP, **Status**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - A-Test-Connection indication not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.9.3 ATCRS

Function

The ATCRS procedure call shall be used to respond to a received A-Test-connection indication.

Procedure call and arguments

ATCRS	P-ACEP, Result, **Status**.
P-ACEP	Integer. ACEP identifier.
Result	Integer. (See 5.11). Result ok. Remote service user unavailable.
Status	Integer. Status on return. +1 - Call accepted. -1 - Call not accepted due to flow control. Call must be repeated later. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.

5.9.4 ATCC

Function

The ATCC procedure call shall be used to receive an A-Test-Connection confirmation.

Procedure call and parameters

ATCC	P-ACEP, **Status**, **Result**.
P-ACEP	Integer. ACEP identifier.
Status	Integer. Status on return. +1 - Successful call. 0 - A-Test-Connection confirmation not received. -2 - Illegal argument. -3 - Provider out of operation. -4 - Illegal use.
Result	Integer. (See 5.11). Result ok. No answer from remote part of provider. Remote service user unavailable. Misbehaviour of remote service user. Misbehaviour of remote part of provider.

5.10 Event Waiting Procedures

5.10.1 ASWAIT

Function
The ASWAIT interface procedure is used by an AS user to wait for some event significant to the AS user on a given ACEP.

Procedure call and arguments

ASWAIT P-ACEP, time-out, **Status**, **Event**.

P-ACEP Integer. ACEP identifier.

time-out Integer. Maximum waiting time in seconds.
>0 - Time-out in seconds.
=0 - Immediate return (poll effect).
<0 - No time-out specified, wait until event occurs.

Status Integer. Status on return.
+1 - Event occured.
0 - Time-out occured.
-3 - Provider out of operation.

Event Integer. Code identifying the event.
(Only relevant if status = +1).
1 - Connect indication (ACONI).
2 - Connect confirmation (ACONC).
3 - Release indication (ARELI).
4 - Release confirmation (ARELC).
5 - Provider abort indication (APABT).
7 - The AS provider is now ready to accept information transfer in the direction from AS user to AS provider.
11 - A-Group-Mgnt indication (AGMI).
12 - A-Group-Mgnt confirmation (AGMC).
13 - A-Def-Group indication (ADGI).
14 - A-Def-Group confirmation (ADGC).
15 - A-Get-Group indication (AGGI).
16 - A-Get-Group confirmation (AGGC).
17 - A-Init-Transfer indication (AITI).
18 - A-Data indication (ADTI).
19 - A-Conf-Data indication (ACDI).
20 - A-Spont-Mgnt indication (ASMI).
21 - A-Spont-Mgnt confirmation (ASMC).
22 - A-Test-Connection indication (ATCI).
23 - A-Test-Connection confirmation (ATCC).
25 - A-Command-Transfer indication (ACTI).
26 - A-Command-Transfer confirm (ACTC).
27 - A-Mixed-Data indication (AMDI).

28 - A-Mixed-Data Error indication (AMDEI).

5.10.2 AGWAIT

Function

The AGWAIT interface procedure is used by an AS user to wait for some event significant to the AS user on any ACEP.

Procedure call and arguments

AGWAIT	Entity-id, time-out, **Status**, **U-ACEP**, **Event**
Entity-id	Integer. Unique identification of the local user entity. (The same value as used in the AATT call must be supplied.)
time-out	Integer. Maximum waiting time in seconds. >0 - Time-out in seconds. =0 - Immediate return (poll effect). <0-No time-out specified, wait until event occurs.
Status	Integer. Status on return. +1 - Event occurred. 0 - Time-out occurred. -2 - Illegal argument. -3 - Provider out of operation.
U-ACEP	Integer. ACEP identifier denoting the ACEP where an event has occurred.

Event Integer. Code identifying the event.
(Only relevant if status = +1).

1 - Connect indication (ACONI).
2 - Connect confirmation (ACONC).
3 - Release indication (ARELI).
4 - Release confirmation (ARELC).
5 - Provider abort indication (APABT).
7 - The AS provider is now ready to accept information transfer in the direction from AS user to AS provider.
11 - A-Group-Mgnt indication (AGMI).
12 - A-Group-Mgnt confirmation (AGMC).
13 - A-Def-Group indication (ADGI).
14 - A-Def-Group confirmation (ADGC).
15 - A-Get-Group indication (AGGI).
16 - A-Get-Group confirmation (AGGC).
17 - A-Init-Transfer indication (AITI).
18 - A-Data indication (ADTI).
19 - A-Conf-Data indication (ACDI).
20 - A-Spont-Mgnt indication (ASMI).
21 - A-Spont-Mgnt confirmation (ASMC).
22 - A-Test-Connection indication (ATCI).
23 - A-Test-Connection confirmation (ATCC).
25 - A-Command-Transfer indication (ACTI).
26 - A-Command-Transfer confirm (ACTC).
27 - A-Mixed-Data Indication (AMDI).
28 - A-Mixed-Data Error Indication (AMDEI).

5.11 Reason/Result Parameter Values

Mnemonic	Value	Text
A-R0	0	Result ok.
A-RC1	1	Local lack of resources.
A-RC2	2	Remote lack of resources.
A-RC3	3	Quality of service below minimum level.
A-RC4	4	No answer from remote system.
A-RC5	5	Remote service user unavailable (connection phase).
A-RC6	6	Called user unknown.
A-RC7	7	Misbehaviour of local service user. (connection phase).
A-RC8	8	Misbehaviour of remote service user (connection phase).
A-RC9	9	Misbehaviour of local part of provider.
A-RC10	10	Misbehaviour of remote part of provider. (connection phase). (Can also be caused by remote lower level provider)
A-RC11	11	Termination of duplicate connection.
A-RC12	12	Collision.
A-RC13	13	Incompatible versions.
A-RC14	14	Rejected by remote Application level.
A-RC15	15	Security is not supported by A service user
A-RC16	16	Incompatible security options requested
A-RC17	17	Authentication failure
A-RC18	18	Invalid Message Authentication Code received
A-RC19	19	Decipherment error
A-RC20	20	Certificate Reject By Responder
A-RC21	21	Responder Certificate Mismatch
A-RC22	22	TLS Unavailable
A-RC23	23	TLS Error
	30 - 50	No available lower level connection.
A-RC30	30	Remote party clears.
A-RC31	31	Number busy.
A-RC32	32	Out of order.
A-RC33	33	Network congestion.
A-RC34	34	Other (call progress signal).
A-RC35	35	Lower levels can not establish a connection within the specified time limit.
A-RC36	36	Rejected by service user.
A-RC40	40	Network Entity disconnected by supervisor.
A-RC41	41	Disconnected by the network layer.
A-RC42	42	Disconnected by the remote transport entity.
A-RC43	43	Disconnected by the local transport entity.
A-RC44	44	Remote transport entity congestion.
A-RC45	45	Protocol error.
A-RC46	46	Transport connection reference error.
A-RC47	47	Connect negotiation failed.
A-RD1	65	Gtype out of range.
A-RD2	66	Gnr out of range.
A-RD3	67	Gsize out of range.

Mnemonic	Value	Text
A-RD4	68	Objlength out of range.
A-RD5	69	Index out of range.
A-RD6	70	TO out of range.
A-RD7	71	Dt out of range.
A-RD8	72	No memory.
A-RD9	73	Group exists.
A-RD10	74	Not deletable.
A-RD11	75	Objid unknown.
A-RD12	76	Config buffer overflow.
A-RD13	77	Not reconfigurable.
A-RD14	78	No answer from remote part of provider.
A-RD15	79	Remote service user unavailable (data transfer phase).
A-RD16	80	Misbehaviour of remote service user (data transfer phase).
A-RD17	81	Misbehaviour of remote part of provider (data transfer phase).
A-RD18	82	T out of range.
A-RD19	83	Spontaneous transfer not initiated.
A-RD20	84	Misbehaviour of local service user (data transfer phase).
A-RD21	85	Priority class out of range.
A-RD22	86	Time mode out of range.
A-RD23	87	Command type out of range.
A-RD24	88	Time mode not supported by A service user.
A-RD25	89	Command mode not supported by A service user.
A-RD26	90	EXC command different from CBXC.
A-RD27	91	CBXC not received before EXC.
A-RSYSTEM	128-254	System implementation dependent reason.
A-RUNKNOWN	255	Unknown reason.