INTERNATIONAL STANDARD

IEC 60870-6-802

Edition 2.1

2005-09

Edition 2:2002 consolidated with amendment 1:2005

Telecontrol equipment and systems –

Part 6-802: Telecontrol protocols compatible with ISO standards and ITU-T recommendations – TASE.2 Object models

Reference number
IEC 60870-6-802:2002+A1:2005(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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FOREWORD

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International Standard IEC 60870-6-802 has been prepared by IEC technical committee 57: Power system control and associated communications.

This consolidated version of IEC 60870-6-802 consists of the second edition (2002) [documents 57/575/FDIS and 57/583/RVD] and its amendment 1 (2005) [documents 57/740/FDIS and 57/745/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annex A is for information only.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The primary purpose of Telecontrol Application Service Element (TASE.2) is to transfer data between control systems and to initiate control actions. Data is represented by object instances. This part of IEC 60870 proposes object models from which to define object instances. The object models represent objects for transfer. The local system may not maintain a copy of every attribute of an object instance.

The object models presented herein are specific to "control centre" or "utility" operations and applications; objects required to implement the TASE.2 protocol and services are found in IEC 60870-6-503. Since needs will vary, the object models presented here provide only a base; extensions or additional models may be necessary for two systems to exchange data not defined within this standard.

It is by definition that the attribute values (i.e. data) are managed by the owner (i.e. source) of an object instance. The method of acquiring the values are implementation dependent; therefore accuracy is a local matter.

The notation of the object modelling used for the objects specified in clause 5 is defined in IEC 60870-6-503. It should be noted that this part of IEC 60870 is based on the TASE.2 services and protocol. To understand the modelling and semantics of this standard, some basic knowledge of IEC 60870-6-503 is recommended.

Clause 5 describes the control centre-specific object models and their application. They are intended to provide information to explain the function of the data.

Clause 6 defines a set of MMS type descriptions for use in exchanging the values of instances of the defined object models. It is important to note that not all attributes of the object models are mapped to types. Some attributes are described simply to define the processing required by the owner of the data and are never exchanged between control centres. Other attributes are used to determine the specific types of MMS variables used for the mapping, and therefore do not appear as exchanged values themselves. A single object model may also be mapped onto several distinct MMS variables, based on the type of access and the TASE.2 services required.

Clause 7 describes the mapping of instances of each object type MMS variables and named variable lists for implementing the exchange.

Clause 8 describes device-specific codes and semantics to be used with the general objects.

An informative annex is included which describes some typical interchange scheduling scenarios, along with the use of TASE.2 objects to implement the schedule exchange.

TELECONTROL EQUIPMENT AND SYSTEMS –

Part 6-802: Telecontrol protocols compatible with ISO standards and ITU-T recommendations – TASE.2 Object models

1 Scope

This part of IEC 60870 specifies a method of exchanging time-critical control centre data through wide-area and local-area networks using a full ISO compliant protocol stack. It contains provisions for supporting both centralized and distributed architectures. The standard includes the exchange of real-time data indications, control operations, time series data, scheduling and accounting information, remote program control and event notification.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60870-5-101:1995, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 101: Companion standard for basic telecontrol tasks*

IEC 60870-6-503:2002, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations – Section 503: TASE.2 Services and protocol*

ISO 9506-1:2000, *Industrial automation systems – Manufacturing message specification – Part 1: Service definition*

ISO 9506-2:2000, *Industrial automation systems – Manufacturing message specification – Part 2: Protocol specification*

3 Definitions

For the purposes of this part of IEC 60870, the definitions in the above referenced standards apply.

4 Abbreviations

For the purposes of this part of IEC 60870, all the abbreviations defined in the above referenced standards apply.

5 Object models

Object models are required for various functions within a system. This clause delineates abstract object models based on functionality. Object models within one functional area may be used in another functional area.

5.1 Supervisory Control and Data Acquisition

The object models in this clause are derived from the historical perspective of Supervisory Control and Data Acquisition (SCADA) systems. The following text presents the context within which the object models are defined.

Fundamental to SCADA systems are two key functions: control and indication. The control function is associated with the output of data whereas the indication function is associated with the input of data. A more recent concept that is finding usage is the control and indication function where data output may also be input (i.e. bi-directional).

The previous identified functions within SCADA systems are mapped to point equipment (point). The primary attribute of a point is the data value. SCADA systems define three types of data for points: analog, digital and state.

The association of one or more points together is used to represent devices. For example, a breaker device may be represented by a control point and an indication point. The control point represents the new state that one desires for the breaker device. The indication point represents the current state of the breaker device. For SCADA to SCADA data exchange (e.g. control centre to control centre, control centre to SCADA master, etc.), additional data is often associated with point data. Quality of point data is often exchanged to defined whether the data is valid or not. In addition, for data that may be updated from alternate sources, quality often identifies the alternate source. Select-Before-Operate control is associated with Control Points for momentary inhibiting access except from one source. Two other informative data values are: time stamp and change of value counter. The time stamp, when available, details when a data value last changed. The change of value counter, when available, details the number of changes to the value.

From the context presented, the primary object models required are: Indication Point, and Control Point. The attributes Point Value, Quality, Select-Before-Operate, Time Stamp, and Change of Value Counter are required to meet the desired functionality for data exchange. The Indication Point and Control Point models may be logically combined to a single model to represent a device which implements a control function with a status indication as to its success/failure. The combined logical model will result in the same logical attributes, and map onto the same MMS types as the independent models.

5.1.1 IndicationPoint Object

An IndicationPoint object represents an actual input point.

Object: **IndicationPoint** (Read Only)
- Key Attribute: PointName
- Attribute: PointType (REAL, STATE, DISCRETE)
- Constraint PointType=REAL
  - Attribute: PointRealValue
- Constraint PointType=STATE
  - Attribute:PointStateValue
- Constraint PointType=DISCRETE
  - Attribute: PointDiscreteValue
- Attribute: QualityClass: (QUALITY, NOQUALITY)

Constraint: QualityClass = QUALITY
Attribute: Validity (VALID, HELD, SUSPECT, NOTVALID)
Attribute: CurrentSource (TELEMETERED, CALCULATED, ENTERED, ESTIMATED)
Attribute: NormalSource (TELEMETERED, CALCULATED, ENTERED, ESTIMATED)
Attribute: NormalValue (NORMAL,ABNORMAL)
Attribute: TimeStampClass: (TIMESTAMP, TIMESTAMPEXTENDED, NOTIMESTAMP)
Constraint: TimeStampClass = TIMESTAMP
Attribute: TimeStamp
Attribute: TimeStampQuality: (VALID, INVALID)
Constraint: TimeStampClass = TIMESTAMPEXTENDED
Attribute: TimeStampExtended
Attribute: TimeStampQuality: (VALID, INVALID)
Attribute: COVClass: (COV, NOCOV)
Constraint: COVClass = COV
Attribute: COVCounter

PointName
The PointName attribute uniquely identifies the object.

PointType
The PointType attribute identifies the type of input point, and must be one of the following: REAL, STATE, DISCRETE.

PointRealValue
The current value of the IndicationPoint, if the PointType attribute is REAL.

PointStateValue
The current value of the IndicationPoint, if the PointType attribute is STATE.

PointDiscreteValue
The current value of the IndicationPoint, if the PointType attribute is DISCRETE.

QualityClass
The QualityClass has the value QUALITY if the object instance has any of the quality attributes (Validity, CurrentSource, or NormalValue), and takes the value NOQUALITY if none of the attributes are present.

Validity
The Validity attribute specifies the validity or quality of the PointValue data it is associated with. These are based on the source system's interpretation as follows:

Validity	Description
VALID	Data value is valid
HELD	Previous data value has been held over. Interpretation is local
SUSPECT	Data value is questionable. Interpretation is local
NOTVALID	Data value is not valid

CurrentSource
The CurrentSource attribute specifies the current source of the PointValue data it is associated with as follows:

CurrentSource	Description
TELEMETERED	The data value was received from a telemetered site
CALCULATED	The data value was calculated based on other data values
ENTERED	The data value was entered manually
ESTIMATED	The data value was estimated (State Estimator, etc.)

NormalSource
The NormalSource attribute specifies the normal source of the PointValue data it is associated with as follows:

NormalSource	Description
TELEMETERED	The data value is normally received from a telemetered site
CALCULATED	The data value is normally calculated based on other data values
ENTERED	The data value is normally entered manually
ESTIMATED	The data value is normally estimated (State Estimator, etc.)

NormalValue
The NormalValue attribute reports whether value of the PointValue attribute is normal. Only one bit is set, it is defined as follows:

NormalValue	Description
NORMAL	The point value is that which has been configured as normal for the point
ABNORMAL	The point value is not that which has been configured as normal for the point

TimeStampClass
The TimeStampClass attribute has the value TIMESTAMP or TIMESTAMPEXTENDED if the IndicationPoint is time stamped, and has the value NOTIMESTAMP if the IndicationPoint contains no TimeStamp attribute.

TimeStamp
The TimeStamp attribute provides a time stamp (with a minimum resolution of one second) of when the value (attribute PointRealValue, PointStateValue or PointDiscreteValue) of the IndicationPoint was last changed. It is set at the earliest possible time after collection of the IndicationPoint value from the end device.

TimeStampExtended
The TimeStampExtended attribute provides a time stamp (with a resolution of one millisecond) of when the value (attribute PointRealValue, PointStateValue or PointDiscreteValue) of the IndicationPoint was last changed. It is set at the earliest possible time after collection of the IndicationPoint value from the end device.

TimeStampQuality
The TimeStampQuality attribute has the value VALID if the current value of the TimeStamp attribute contains the time stamp of when the value was last changed, and has the value INVALID at all other times.

COVClass
The COVClass (**C**hange **O**f **V**alue Counter) attribute has the value COV if the IndicationPoint contains a COVCounter attribute, otherwise it has the value NOCOV.

COVCounter
The COVCounter attribute specifies the number of times the value (attribute PointRealValue, PointStateValue, or PointDiscreteValue) of the IndicationPoint has changed. It is incremented each time the owner sets a new value for the IndicationPoint.

5.1.2 ControlPoint Object

A ControlPoint Object is an integral part of the services provided by TASE.2. It is used to represent values of various types of data typical of SCADA and energy management systems. Typically, a ControlPoint object will be associated with some real world object.

Object: **ControlPoint** (Write Only, except for attributes CheckBackName, Tag, State and Reason)
- Key Attribute: ControlPointName
- Attribute: ControlPointType: (COMMAND, SETPOINT)
- Constraint: ControlPointType = COMMAND
  - Attribute: CommandValue
- Constraint: ControlPointType = SETPOINT
  - Attribute: SetPointType: (REAL, DISCRETE)
  - Constraint SetpointType=REAL
    - Attribute: SetpointRealValue
  - Constraint SetpointType=DISCRETE
    - Attribute: SetpointDiscreteValue
- Attribute: DeviceClass: (SBO, NONSBO)
- Constraint: DeviceClass = SBO
  - Attribute: CheckBackName
  - Attribute: State: (SELECTED, NOTSELECTED)
  - Attribute: Timeout
- Attribute: TagClass: (TAGGABLE, NONTAGGABLE)
- Constraint: TagClass = TAGGABLE
  - Attribute: Tag: (NO-TAG, OPEN-AND-CLOSE-INHIBIT, CLOSE-ONLY-INHIBIT)
  - Attribute: State: (IDLE, ARMED)
  - Attribute: Reason

ControlPointName
The ControlPointName attribute uniquely identifies the object.

ControlPointType
The value of the ControlPointType attribute for an instance of a ControlPoint will be COMMAND or SETPOINT, indicating the type of controlled device.

CommandValue
The CommandValue attribute indicates the command for a device.

SetPointType
The value of the SetPointType attribute for an instance of a ControlPoint of ControlPointType SETPOINT will be REAL or DISCRETE, indicating the type of setpoint.

SetPointRealValue
The SetPointRealValue attribute may be set with the floating point value requested for the setpoint control.

SetPointDiscreteValue
The SetPointDiscreteValue attribute may be set with the integer value requested for the setpoint control.

DeviceClass
The DeviceClass attribute of an instance of a ControlPoint has the value SBO if the device requires a Select operation before being operated, and the value NONSBO otherwise.

CheckBackName
The CheckBackName attribute contains a symbolic description of the physical object being controlled. This data is returned by the system operating the physical object to the system requesting the operation so that the person or system requesting the operation can be assured the proper object has been selected.

State
The State attribute indicates whether the ControlPoint is SELECTED or NOTSELECTED.

Timeout
The Timeout attribute of an instance of a ControlPoint has the value of the maximum allowed time for which the ControlPoint of DeviceClass SBO may remain SELECTED before operation.

TagClass
The TagClass attribute of an instance of a ControlPoint has the value TAGGABLE if the instance contains a Tag attribute, and otherwise has the value NONTAGGABLE.

Tag
The Tag attribute indicates whether or not the ControlPoint is tagged, and if it is, what the level of tagging is. The Tag attribute can take on the values NO-TAG, OPEN-AND-CLOSE-INHIBIT, CLOSE-ONLY-INHIBIT.

Reason
The Reason attribute contains a message that indicates the reason for tagging.

5.1.3 Protection Equipment Event Object Model

The following object model represents the events generated in the operation of protection equipment. Start events are generated by the protection equipment when it detects faults. Trip events report commands to output circuits which are generated by the protection equipment when it decides to trip the circuit-breaker. Both events are transient information. The protection event models are based on IEC 60870-5-101.

Object: **ProtectionEvent**
KeyAttribute: Name
Attribute: ElapsedTimeValidity (VALID, INVALID)
Attribute: Blocked (NOTBLOCKED, BLOCKED)
Attribute: Substituted (NOTSUBSTITUTED, SUBSTITUTED)
Attribute: Topical (TOPICAL, NOTTOPICAL)
Attribute: EventValidity (VALID, INVALID)
Attribute: ProtectionClass (SINGLE, PACKED)
Constraint: ProtectionClass = SINGLE
Attribute: EventState (INDETERMINATE, OFF, ON)
Attribute: EventDuration
Attribute: EventTime
Constraint: ProtectionClass = PACKED
Attribute: EventClass (START, TRIP)
Constraint: EventClass = START
Attribute: StartGeneral (NOSTART, START)
Attribute: StartPhase1 (NOSTART, START)
Attribute: StartPhase2 (NOSTART, START)
Attribute: StartPhase3 (NOSTART, START)
Attribute: StartEarth (NOSTART, START)
Attribute: StartReverse (NOSTART, START)
Attribute: DurationTime
Attribute: StartTime