

INTERNATIONAL STANDARD

IEC 60870-6-802

Second edition
2002-04

Telecontrol equipment and systems –

Part 6-802:

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

Matériels et systèmes de téléconduite –

Partie 6-802:

*Protocoles de téléconduite compatibles avec les
normes ISO et les recommandations de l'UIT-T –
Modèles d'objets TASE.2*



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TELECONTROL EQUIPMENT AND SYSTEMS –

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

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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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 second edition cancels and replaces the first edition published in 1997 and constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/575/FDIS	57/583/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annex A is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2004. 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- withdrawn;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

Constraint: EventClass = TRIP

Attribute: TripGeneral (NOTRIP, TRIP)

Attribute: TripPhase1 (NOTRIP, TRIP)

Attribute: TripPhase2 (NOTRIP, TRIP)

Attribute: TripPhase3 (NOTRIP, TRIP)

Attribute: OperatingTime

Attribute: TripTime

Name

The Name attribute uniquely identifies the protection event.

ElapsedTimeValidity

The elapsed time (attribute EventDuration, DurationTime, or OperatingTime depending on the event type) is valid if it was correctly acquired. If the acquisition function detects invalid conditions, the ElapsedTimeValidity attribute is INVALID, otherwise it is VALID.

Blocked

The Blocked attribute is BLOCKED if the value of protection event is blocked for transmission, and is NOTBLOCKED otherwise. The value remains in the state that was acquired before it was blocked. Blocking and deblocking may be initiated by a local lock or by a local automatic cause.

Substituted

The Substituted attribute takes the value SUBSTITUTED if the event was provided by input of an operator (dispatcher) or by an automated source.

Topical

The Topical attribute is TOPICAL if the most recent update was successful, and is NOTTOPICAL if it was not updated successfully during a specified time interval or is unavailable.

EventValidity

The EventValidity attribute takes the value INVALID if the acquisition function recognizes abnormal conditions of the information source, otherwise it is VALID.

ProtectionClass

The ProtectionClass attribute identifies the type of protection event, and must be one of the following: SINGLE or PACKED.

EventState

The EventState attribute of a SINGLE protection event takes the value of the protection event: OFF, ON or INDETERMINATE.

EventDuration

The EventDuration attribute takes the value of the event duration (total time the fault was detected) or operation time (time between start of operation and trip command execution).

EventTime

The EventTime attribute signifies the time of the start of the operation.

EventClass

The type of protection event being reported. The value START signifies a start event, and TRIP signifies a trip event.