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Australian Standard[®]

Telecontrol equipment and systems

Part 4: Performance requirements

This Australian Standard was prepared by Committee IT/24, Supervisory Control and Data Acquisition. It was approved on behalf of the Council of Standards Australia on 5 January 1998 and published on 5 April 1998.

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OF

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Telecontrol equipment and systems

Part 4: Performance requirements

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NOTES

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Telecontrol equipment and systems
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PREFACE

This Standard was prepared by the Standards Australia Committee IT/24, Supervisory Control and Data Acquisition.

The Standard is identical with and has been reproduced from IEC 60870-4:1990, *Telecontrol equipment and systems, Part 4: Performance requirements*.

IEC has decided to apply a new numbering system, the 60000 series, to all its existing and future publications, including amendments to existing Standards. As a consequence, IEC has modified the bibliographic references in its databases to accord with the new numbering system. All IEC publications issued since the beginning of 1997 will carry references in terms of the 60000 series numbering. Publications printed earlier than 1997 will continue to carry the old series of numbers. For example, a reference to the IEC 60870 series of Standards will be to IEC 870 if the current edition of the Standard was printed prior to 1997.

This Standard is identical with a pre-1997 document therefore it uses the old series of numbers.

The objective of this Standard is to provide manufacturers and users of telecontrol equipment and systems with a set of rules for accessing and specifying performance requirements in order to determine the requirements for a particular telecontrol system to be used in Australia.

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NOTES

AUSTRALIAN STANDARD

TELECONTROL EQUIPMENT AND SYSTEMS

Part 4: Performance requirements

INTRODUCTION

Reliable and secure remote monitoring and control of a geographically widespread process is the ultimate goal of a telecontrol system. This standard covers those aspects which contribute to achieving a level of system performance consistent with that goal.

The approach adopted in this standard has been to treat the subject of performance requirements on the basis of the inherent properties of telecontrol systems.

The inherent properties of a system are those intangibles, such as availability, time parameters, etc., which in many ways affect the overall system performance. During normal system operation, these properties and their effect on the system performance go largely unnoticed. Their real value is only noticed in exceptional circumstances, such as on detection of a fault, or when it is necessary to extend the system. The system performance, especially under these conditions, reflects the consideration given to these properties in the planning, design and manufacture of the equipment.

In determining the performance requirements for a particular telecontrol system, care should be taken to stipulate standards which are adequate for the specific application, without being tempted to place excessive demands. A balance should be found between the ideal requirements on the one hand, and the technical and financial consequences on the other hand.

1. Scope

This series of standards applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and control of geographically widespread processes. The scope of this standard embraces telecontrol systems in the restricted sense, as shown in IEC Publication 870-1-1, figure 2.

2. Object

This part deals with those characteristics which affect the performance of telecontrol systems and relates the characteristics to the application and processing functions.

The object of this part is to establish a set of rules which can be used to assess and specify the performance requirements of telecontrol systems.

It is intended that this part serves as a common platform for the system planner and the supplier or manufacturer of telecontrol systems. The system planner will find the contents helpful in determining the requirements for a particular telecontrol system. In addition, these rules provide a means of comparing the products of different suppliers. The supplier or manufacturer will find guidelines for the system design and a base for classification of system performance.

This part comprises a main body, which contains the actual standard, together with two appendices, which contain further information and recommendations.

The main body is devoted chiefly to a treatment of the various characteristics as operational parameters. A short description of each operational parameter is followed by a list of the necessary performance requirements and, where feasible, a classification of the operational parameters in performance classes.

The performance classes serve to specify the system requirements for a particular application and to evaluate the system performance of different telecontrol systems.

The performance classes used are to be optimized for each application and agreed upon between the user and the supplier.

3. **Classification of operational parameters**

This clause covers those properties which influence the performance of telecontrol systems. Appropriate requirements and, where feasible, performance classes have been specified for each of the properties covered.

The classification ratings given apply in general to the performance of the units of the overall system. The performance of the overall system shall be derived from the performance of all components of a telecontrol system (in the restricted sense), excluding the process and the operator's equipment. Certain properties, however, such as reliability and availability, can be applied as performance criteria to individual items of equipment. The components of an overall system are, for instance:

- substations;
- nodes;
- transmission lines;
- central processor;
- man/machine interface.

The requirements for a particular telecontrol system are dependent on the specific application and are invariably subject to agreement between supplier and user.

3.1 Reliability

Reliability is defined as a measure of an equipment or system to perform its intended function under specified conditions for a specified period of time (see IEC Publications 271, 271A and 300). It is a probability figure, based on failure data and length of operating time.

The reliability of a telecontrol system is expressed by the “mean time between failures” in hours (MTBF), and can be calculated from the reliability figures of the individual system components (see the standards of Technical Committee No. 56).

The reliability of a system depends on the following factors:

- the reliability of the system equipment and the software;
- the configuration of the system.

Measures which may enhance the reliability are listed in appendix A, clause A.1.

3.1.1 Reliability requirements

The overall system reliability and partial reliabilities of certain specified sections of the telecontrol system are to be calculated by the supplier from the reliability figures of the individual components, and proved against the actual performance in the field over a given trial period. The start and duration of the trial period should be agreed upon between the supplier and the user and should exclude the early failure period.

The equipment supplier should provide on request failure distribution data for all components, assemblies and units which, on failure, could cause loss of a function or malfunction of the system.

The failure modes and the effects of failures on the system performance shall be analysed by the supplier and the results made available on request.

3.1.2 Reliability classes

In the reliability classes provided in table 1, the values given refer to the reliability of the units of the overall system.

Table 1 — Reliability classes

Reliability class	MTBF
R1	MTBF $\geq$ 2 000 h
R2	MTBF $\geq$ 4 000 h
R3	MTBF $\geq$ 8 760 h

3.2 Availability

The availability of a unit of a system characterizes its ability to perform its required function at any given moment.

The availability is a probability figure which concerns operation at a given instant, in contrast to reliability which concerns operation over a given period.

The availability of a unit of the overall system, expressed in "A", may be calculated using the equation:

$$A = \frac{\text{uptime}}{(\text{uptime} + \text{downtime})} \cdot 100\% \quad (1)$$

In applications where outages due to preventive maintenance degrade system operation, the downtime in equation (1) should be the sum of the corrective maintenance and the preventive maintenance.

For hardware design analysis and for prediction of availability of system subassemblies and units, equation (2) shall be used, utilizing MTBF and MTTR as defined in subclauses 3.1 and 3.3 respectively:

$$A_p = \frac{\text{MTBF}}{(\text{MTBF} + \text{MTTR})} \cdot 100\% \quad (2)$$

where

A_p is the predicted availability.

This equation governs the relationship between the values given in tables 1 to 4. Therefore these values may not be combined arbitrarily.

Measures aimed at improving the system availability are given in appendix A, clause A.2.

3.2.1 Requirements

The class or classes of availability applicable to the telecontrol system and subsystems under consideration are subject to agreement between supplier and user.

The availability of telecontrol systems or equipment already in operation, shall be calculated using equation (1), on the basis of statistics provided by operating and maintenance records. The records should cover a time period of not less than 6 months for systems and 12 months for equipment, starting after elapse of the early failure period.

For equipment not yet installed, equation (2) should be used to calculate the predicted availability of the overall system as well as the major system components, such as master station equipment, outstation equipment, etc., and computer peripheral devices. The calculated results should be checked against the performance in the field once the equipment has been operating for the time required to exclude the early failures.

The consequence of outages of individual system elements or functions on the overall system availability and of planned preventive maintenance should be mutually agreed upon between the user and the supplier.

3.2.2 Availability classes

In the availability classes provided in table 2, the values given, unless otherwise stated, refer to the availability of the units of the overall system.

Table 2 — Availability classes

Availability class	Availability A
A1	$A \geq 99.00\%$
A2	$A \geq 99.75\%$
A3	$A \geq 99.95\%$

3.3 Maintainability

Maintainability is the ability of a system or equipment under given conditions of use, after detection of a fault, to be restored to full working order and to be maintained during normal working operation.

The maintainability, whilst being influenced by the respective maintenance organization, is mainly dependent on the serviceability and thus on the layout of the equipment, together with the diagnostic facilities provided.

Maintainability is expressed by the “mean time to restoration” in hours (MTTR), which is given by the sum of the following components:

- administration time: the time interval between detection of a fault and notification of the maintenance service;
- transport time: the time interval between notification of the maintenance service and the arrival on site of the maintenance personnel together with the necessary equipment;
- mean repair time (MRT): the mean time required by trained maintenance personnel on site, equipped with replacement parts and the recommended test equipment, to diagnose and to rectify the fault, including retesting the equipment.