Recommendation T/CS 01-10 (Montpellier 1984)

DOCUMENTATION REQUIREMENTS FOR DIGITAL SWITCHING SYSTEMS

Recommendation proposed by Working Group T/WG 11 "Switching and Signalling" (CS)

Text of the Recommendation adopted by the "Telecommunications" Commission:

"The European Conference of Postal and Telecommunications Administrations,

considering

— that there is a world wide trend in introducing digital exchanges into the public switched telephone networks;

— that Administrations may introduce several types of digital systems into their telephone network;

— that these digital exchanges can only be operated and maintained when there is an adequate documentation;

— that the content and structure of the documentation employed by different manufacturers vary considerably;

— that this diversity presents difficulties in the operation of several types of systems in one national network,

recommends

that members of the CEPT, when specifying their national documentation requirements, adopt the approach outlined in this Recommendation."

Contents

Part I. *Foreword*

1. GENERAL

It is clear that modern switching systems, especially digital, can only be planned, installed, tested and operated if appropriate documentation is available. The types of documentation range from a general representation of the system, which may represent a part of documentation needed during the tendering stage, through to a detailed description and other documents usually required when a contract is concluded. The structure of documentation employed by different manufacturers varies considerably and this diversity presents difficulties when comparing systems and in the operation of several types of systems in one national network.

It is recognised that some administrations may already have defined their documentation requirements and agreed these with their switching system suppliers. Changes to these requirements and agreements may not be practical in the short term, but it is recommended that administrations adopt the general approach outlined in this Recommendation in the longer term.

It is not expected that manufacturers should be required to change their existing documentation to meet this Recommendation, but they should at least demonstrate that they have covered all the points highlighted in the following structure.

It should be pointed out that the subject "documentation" is also dealt with in chapter VII of CCITT Handbook GAS 6 (Choice of telephone switching systems). If parts thereof have been used in this Recommendation it is expressly noted.

2. SCOPE OF THE RECOMMENDATION

This Recommendation covers the general documentation requirements for digital switching systems but to a large extent it can also be applied to SPC switching systems in general.

The objective of this Recommendation is to provide a generally applicable basis for the requirements imposed on documentation, special emphasis being placed on obtaining a common understanding of the terms used by defining them clearly.

The Recommendation should serve both manufacturers of digital switching systems, and their customers, as a guideline or check list which will help in the preparation of a complete set of documents capable of meeting the various needs of the users.

This Recommendation is only concerned with the documentation supplied by manufacturers. At a later stage, harmonisation of the documentation that administrations provide to manufacturers for tendering purposes may be considered.

Although complete harmonisation of documentation was considered, some points are the subject of national standards, specifications or a matter of negotiation between manufacturer(s) and customer and will be specified in the contract, for example:

— the language used;

— the media on which the documentation is presented and the way in which it is presented;

— the way in which the documentation is separated into the parts required by individual departments within an administration (planning, operations, maintenance, etc.);

— the type, amount and level of detail or the documentation required by an administration at any stage, from tendering through to the introduction of a switching system into operation, and beyond into the operational phase;

— provisions for updating documentation;

— the relationship of the switching documentation with
  • the general requirements for other documentation within an administration
    and
  • the documentation facilities already in use within an administration.

3. LAYOUT OF THE RECOMMENDATION

In part II of the Recommendation a general structure is presented giving an overall view of switching system documentation.

This structure is also used as the basis for the layout of this Recommendation.

Part II. *Documentation requirements for digital switching systems*

1. GENERAL

1.1. Structure of the documentation

The documents required should be classified in an hierarchical structure.

In Figure 1 (T/CS 01-10) a general hierarchical structure has been presented to provide an overall view of switching system documentation recommended. This particular structure has been agreed as reasonable in view of the complexity of the documentation involved: it is acknowledged that variants of this structure may exist.

The structure presented in Figure 1 considers two main aspects:
— the purpose an individual document serves
   and
— the level of detail a document contains.

For the site independent, see in description and detailed documents (see § 3.1 to 3.3 below), four different levels of detail are adopted. They are identified by the digits 1 (most general information) through to 4 (most detailed information).

The structure only considers system-related documents, to be provided by manufacturers of digital exchanges for use by administrations.

Other types of documentation, e.g.
— manufacturer/supplier specific documentation;[1]
— system-independent documentation;[2]
   and
— system support documentation[3]

are not taken into account.

Notes:

[1] Documents of this type cover the wide range of tasks which a manufacturer has to perform in the field of development, testing, production and administration of the systems software modules and hardware units.

[2] Typical examples to this type of documentation are manuals, descriptions, etc. of peripheral equipment (e.g. teletypes, visual display units, magnetic tape units, printer terminals, disc units). Usually this equipment is not developed or produced especially for the exchange system. Since this equipment is necessary for system operation and/or maintenance there must be an adequate documentation.

[3] In addition to the hardware and the software used in the SPC switching equipment, additional sofware or hardware and the corresponding documentation may be required for development/maintenance of the exchange software, repair of slide-in units, training purposes, etc.

1.2. General requirements for software documentation

Software documentation is considered to be a very significant, if not the most important, part of the whole documentation. Therefore, it has to be stressed that the different sections of software descriptions must meet the following general requirements:

The documentation of the whole software system is assumed to be organized according to the top-down principle and structured in a task oriented way. This means that the software documentation starts with a software system overview (level 1), goes on with a description of the functions of the sub-systems (level 2) and terminates with the documents on module and/or sub-module level (levels 3 and 4). The different documents should be consistent in all respects, and with increasing level number finally lead to the comprehension of the instruction code of the program listing. By searching through the documents at each of the different levels it must be possible to trace each software function and its realization down to module/sub-module level, especially from level 2 to level 4, and vice versa.

1.3. General requirements for hardware documentation

The documentation of the hardware is assumed to be organized according to the top-down principle. This means that the hardware documentation starts with a system overview (level 1), goes on with a description of the sub-systems (level 2) and terminates with the documents for functional and/or constructional units (levels 3 and 4). Where needed the documents should contain references to other hardware or software documents.

System-related documentation

Site-independent documents (see § 3.)

Site-specific documents (see § 4.)

The documentation scheme description (see § 2.)

DESCRIPTIONS

- System overall description (level 1) (see § 3.1.1.)
- Description of sub-systems/functional blocks and special topics (level 2) (see § 3.1.2.)
- Description of hardware (level 3) (see § 3.1.3.)
- Description of software (level 3) (see § 3.1.4.)

MANUALS

- Operating manual(s) (see § 3.4.1.)
- Maintenance manuals (see § 3.4.2.)
- Engineering and ordering manual (see § 3.4.3.)
- Installation methods manual (see § 3.4.4.)
- Acceptance test procedures manual (see § 3.4.5.)
- Command and print-out manual (see § 3.4.6.)
- Manual for repair and testing of equipment (see § 3.4.7.)

DETAILED DOCUMENTS

- Detailed hardware documents (level 4) (see § 3.2.)
  - Documents for components (see § 3.2.1.)
  - Documents for assemblies/sub-assemblies (see § 3.2.2.)
  - Document for standardized equipping and cabling (see § 3.2.3.)
- Detailed software documents (level 4) (see § 3.3.)
  - Module catalogue (see § 3.3.1.)
  - Source listings (see § 3.3.2.)
  - Link listing (see § 3.3.3.)
  - Data Definitions (see § 3.3.4.)

Site-specific documents:
- Detailed hardware documents (see § 4.1.)
- Detailed software documents (see § 4.2.)
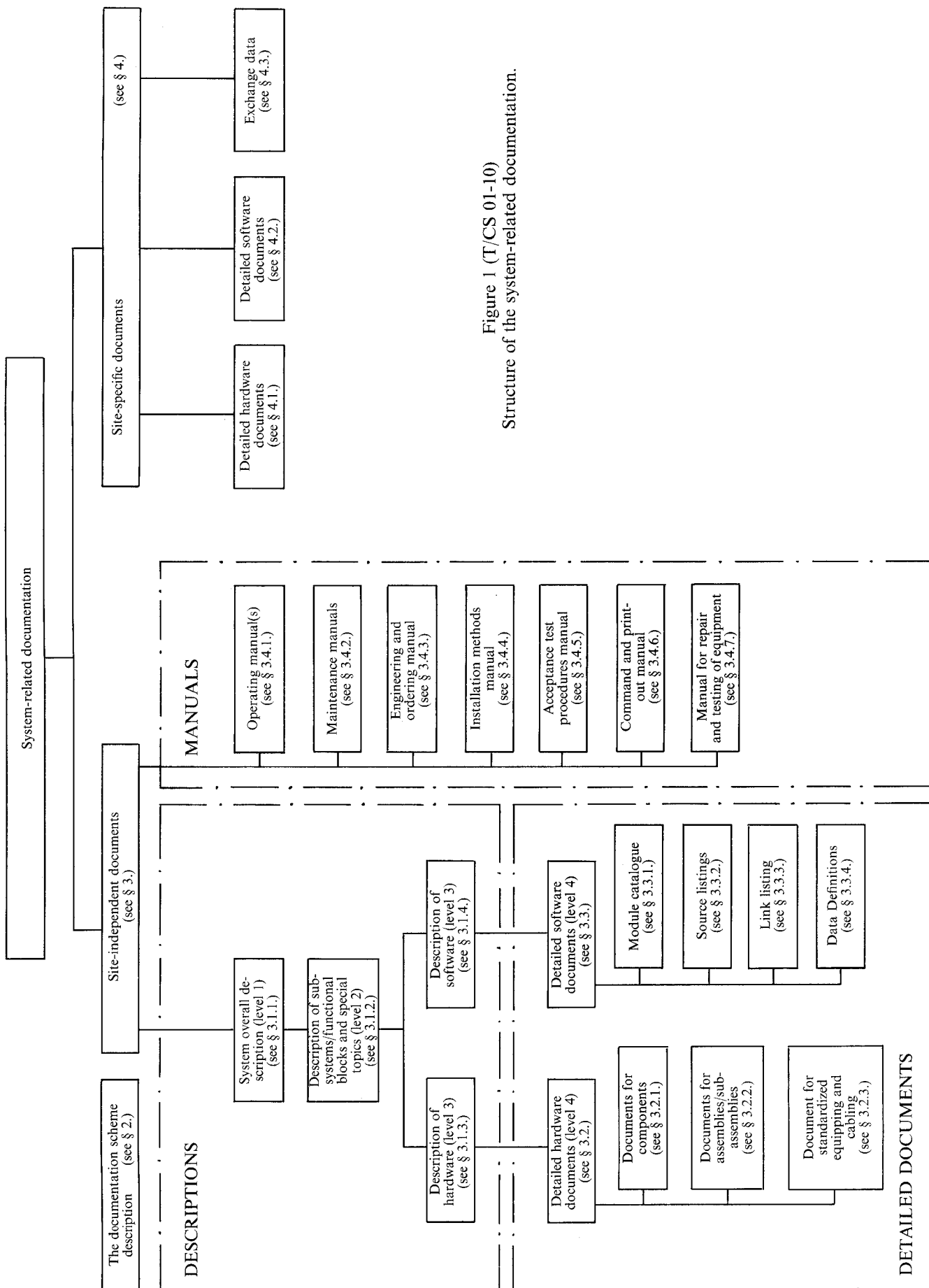- Exchange data (see § 4.3.)

Figure 1 (T/CS 01-10)
Structure of the system-related documentation.

2.   **THE DOCUMENTATION SCHEME DESCRIPTION**

There are two requirements that must be met by the documentation scheme description, viz:
— to introduce potential users to the documentation scheme, its hierarchical structure (see Figure 1 (T/CS 01-10)) and the conventions adopted;
— to permit quick and accurate reference to the contents of the documents.

To meet these requirements, the system documentation scheme description should include:
— a key to the system's documentation;
— an extensive subject index, in alphabetical order together with the normal table of contents;
— a glossary of system dependent technical terms and abbreviations;
— a method of updating the various constituent parts and indicating the compatibility of different documents in terms of their revision number.

3.   **SITE-INDEPENDENT DOCUMENTS**

The site-independent documents describe a switching system without considering the variety of circumstances which might be found with different locations and implementations of exchanges.

3.1.   **Descriptions**

3.1.1.   *System overall description (level 1)*

3.1.1.1.   General requirements

(The following text is an excerpt from the GAS 6 Handbook, chap. VII, point 6.1.1 [1]. Minor changes have been made to achieve consistency with the remainder of this Recommendation.)

This level of system description should provide a comprehensive overall introductory definition of a system's principal parameters, in sufficient detail so as to enable a comparison to be made between systems of the various suppliers.

The system overall description should comprise "high level" descriptions of each of the following areas, as appropriate to a particular system:
— Major functional partitioning of the system:
  • Peripherals, network, controls, maintenance aids.
— Features:
  • Operational   (Numbering, translations, routing, classes of service, traffic observation);
  • Subscriber   (Complete list and description of each feature);
  • Maintenance   (Philosophy and features);
  • Signalling   (Subscriber, inter-exchange and intra-exchange);
  • Charging/Billing;
  • Data.
— Size and capacity:
  • Subscriber line and inter-exchange circuits, size ranges;
  • Subscriber line and inter-exchange traffic capacity;
  • Call processing capacity;
  • Traffic performance;
  • Blocking and load balancing.
— Technology:
  • Peripherals, network, control;
  • Mechanical design: racks, module frames (shelves), slide-in units, floor layout;
  • Physical characteristics;
  • Power.
— Sofware-language, structure and modularity;
— Environmental characteristics;
— National/International Standards applicable:
  • Electrical/mechanical/software/environment/reliability.
— Transmission characteristics;
— Reliability;
— Key-to-system specification and documentation structure.

3.1.1.2. Special requirements for software documentation

Software documentation on system level should include:
- a general overview of the software system;
- a list of all sub-systems (e.g. for call processing, operation and maintenance) and a clear description of their functions;
- a short description of the inter-action principles of the sub-system.

3.1.2. *Description of sub-systems/functional blocks and special topics (level 2)*

3.1.2.1. Sub-systems/functional blocks

This documentation should provide details of each major functional partition (sub-system/functional block), of the system.

Examples of sub-systems/functional blocks are:
— hardware:
  - the line/trunk terminating modules;
  - the systems processing unit(s);
  - the switching network.
— software:
  - the processor(s) operating system(s);
  - the software for alarm handling;
  - the software for traffic statistics.

3.1.2.1.1. General requirements

The sub-system description should indicate the implementation of the functional requirements in terms of the internal structure and logical processes of the system, as a whole.

The realization of the functions/sub-systems in hardware, software and firmware as well as the inter-action and relationship of the constituent parts, be they hardware, software or firmware, shall be explained for each major area. The inter-actions between the sub-systems/functional blocks shall also be described.

3.1.2.1.2. Special requirements for hardware descriptions

The description of the sub-systems/functional blocks should include the methods applied for signal transmission and the timing conditions between the functional blocks.

3.1.2.1.3. Special requirements for software documentation

Software documentation on sub-system level should at least include:
— a description of the functions to be performed by the sub-systems (including operating system(s) and data base(s));
— a list of the sub-system's modules;
— a clear description of the inter-action of the sub-system's modules supported by diagrams as appropriate;
— a clear description of the sub-systems software interfaces.
Furthermore, the following subjects should be covered by descriptions:
— the program and data organisation;
— the distribution of the programs and data into the different storage media (RAM, PROM, etc.);
— the program and data residence principles applied *(Note 1)*.

Note 1: Software may reside in the working storage of the system's control(s) and therefore have realtime properties, or it may be stored on external media, e.g. discs, and can therefore only be used after a loading process.

3.1.2.1.4. Special requirements for firmware documentation

The logical part of the firmware should be described in the same manner as the software and the physical functions should use hardware documentation practice.

3.1.2.2. Special topics

Since several subjects which might be of some importance to administrations cannot be described in connection with sub-systems/functional blocks, they should be dealt with at level 2 as special topics.

Special topics are, e.g.:
— the operation and maintenance concept, and associated equipment as proposed by the supplier;
— extension capabilities and procedures;
— a description of the set-up and release procedures for connections;
— line/trunk tests and measurements;
— training of personnel.

3.1.3. *Descriptions of hardware (level 3)*

Descriptions on this level, together with other hardware documents (see § 3.2.), provide a precise comprehension of the operation of the hardware. Therefore, descriptions should be provided for each functional unit of the system (e.g. processor, switching network). Whenever the need arises, descriptions should also be supplied for complex components (e.g. codecs) and for assemblies/sub-assemblies (e.g. slide-in units). Moreover, the inter-action of hardware and software should be explained when necessary.

3.1.4. *Description of software (level 3)*

Level 3 software documents describe the system's software on module/sub-module level. These descriptions must meet two main requirements, namely:
— to provide a precise comprehension of the software;
— to facilitate the execution of work on the software (e.g. identification of software errors, software maintenance).

All appropriate means of explanation and illustration, including flowcharts, SDL, structural and other diagrams, preferably using international standards, shall be provided in the documentation of software. References from and to other levels of documentation should be made.

The following documents may be incorporated into the detailed description of software
• the module's/sub-module's identification with its update level;
• functional description of modules and/or sub-modules;
• description of the module's software interfaces, including the means for exchanging information (e.g. messages), as well as a rough presentation of the module's environment;
• a description of the structure of all applied data and the access mechanism(s) applied;
• the specification for functional testing (if necessary);
• the system of data-administration and data-management;
and additionally:
• the manuals of the programming languages used;
• the programming conventions adopted. (Programming conventions contain the guidelines relevant for the design and the production of the whole software system.)

3.2. Detailed hardware documents (level 4)

In contrast to descriptions (see § 3.1.), the main objective of which is the explanation of the operation and inter-action of different functions of the digital switching system, these site-independent documents give special and detailed information and/or data on components, and how they are interconnected to form a complete exchange. These documents are necessary to assist the execution of operational activities. In connection with hardware descriptions they also provide a comprehension of the system's operation.

They can be divided into:
— documents for components;
— documents for assemblies/sub-assemblies and
— documents for standardized equipping and cabling.

3.2.1. *Documents for components*

The documentation supplied for components should include:
— a list of component types used;
— physical dimensions;
— performance characteristics and reliability information;
— mounting practice;
— ordering data and sources of supply;
— marking and lead identification.

3.2.2. *Documents for assemblies/sub-assemblies*

Examples of assemblies/sub-assemblies are:
— racks;
— module frames (shelves);
— panels, e.g. a rack mounted maintenance panel to display the operational status of equipment;
— slide-in units.

Table 1 (T/CS 01-10) shows that the means of documentation depend on the object of documentation. Each type of document will not exist for every object. The table does not contain documents such as block diagrams, operation sequence diagrams, setting and operating instructions. These documents do not usually appear as separate documents, they are usually integrated with others (e.g. in descriptions).

Object Means	Wired rack (*Note 1*)	Wired module frame (shelf)	Slide-in units, Panels
Catalogue of drawings/documents	X	X	X
Circuit diagram			X
Parts list (electrical and mechanical)	X	X	X
Layout diagram			X
Wiring diagram/plan	X	X	
Wire designation list	X	X	
List of interfaces and ports (*Note 2*)			X
Mechanical details	X	X	

Table 1 (T/CS 01-10).   Objects and means of detailed hardware documentation.

Note 1: A wired rack or shelf is a rack or shelf without equipment, i.e. slide-in unit.

Note 2: This list relates interfaces and ports, used in functional descriptions, to their physical realisation.

Legend

X = This type of documentation may exist for the designated object or be contained in another document.

3.2.3.   *Documents for standardized equipping and cabling*

The hardware of digital exchanges is composed of the different assemblies/sub-assemblies standardized for a specific digital switching system. Documents are needed that show how wired racks and module frames (shelves) can be equipped with slide-in units and racks combined to form exchanges. Documents for standardized equipping describe, where appropriate, the unique combinations, or alternatively preferred combinations and possible variations.

Documents of this type are:
• standard floor layout lists/plans;
• standard cabling lists/plans;
• standard equipment lists/plans for module frames (shelves), racks and distribution frames as appropriate.

These parts of the documentation may also be contained in the engineering and ordering manual.

3.3.   **Detailed software documents (level 4)**

In contrast to description (see § 3.1.) the main objective of which is the explanation of operation and inter-action of different functions of the digital switching system, these site-independent documents give special and detailed information on software. These documents are necessary to understand the software and to permit work on the software. In connection with software descriptions they also provide a comprehension of the system's operation. As a rule the named documents are automatically generated during the software package generation process.

The following documents form the site-independent software documents:
— the module catalogue;
— the source listings;
— the link listing;
— the data definitions.

3.3.1.   *Module catalogue*

The module catalogue lists the software modules/sub-modules which are part of the switching system's software. In this list each module/sub-module should be described by its name, its function, its update level and its position within the software package structure. The order of the listed items may be
— alphabetically by the module/sub-module names and/or
— by the module's/sub-module's functions.

(The function oriented order is only meaningful when it is in line with the hierarchical structure of the software package as described in § 1.2.)

3.3.2.   *Source listings*

The source listing must be provided for each module/sub-module. The listing contains the source code, and, whenever necessary, explanatory comments.

In addition to that the listing may also contain, in the module headers and elsewhere "in-code" documentation thus complementing some of the descriptions mentioned in § 3.1.4.

3.3.3. *Link listing*

In some cases the link listing will not be fully site-independent. It may contain site-specific parts. Since the following requirements are valid for both parts they are included here.

The link listing should contain:
— the names of the modules/sub-modules;
— the module's/sub-module's absolute position (address) in working storage (when modules with constant loading addresses are concerned);
— the module's/sub-module's length and
— external references to other modules/sub-modules. (This information may be omitted in the link listing when it is contained in the relevant source listing.)

3.3.4. *Data definitions*

The relevant requirements for data definitions, e.g. layout of data blocks need further study.

Note: Other possible requirements, such as the inclusion of the listing of the produced object code, address information, etc. need further study.

3.4. **Manuals**

Manuals contain explanatory text, instruction and guidance, etc. to enable the different sections of the administration to perform their special tasks. Accordingly, manuals should cover the following topics, either in separate documents or where considered appropriate, related topics may be grouped into one manual, e.g. operations, maintenance, commands and print-outs.

Manuals should be provided for the:
— operation of the exchange (operating manual – OMN);
— maintenance of the exchange (maintenance manual – MMN);
— engineering and ordering of equipment;
— installation;
— commands and print-outs;
— acceptance test procedures;
— repair and testing of equipment.

Further manuals are conceivable.

3.4.1. *Operating manual(s)*

The operating manual (OMN) is the basic document for the operation of an exchange. It should contain every service task that may occur and which can be executed by an operator by means of the MML, via the keyboard of an input device. Its structure should be activity-oriented.

Within the OMN each activity should be described in respect of:
— its purpose;
— the conditions that must be fulfilled to permit its execution;
— the necessary data;
— every action to be undertaken.

In detail the OMN should cover the following task groups:
— system handling (principles and general procedures)
  • a description of how to use the OMN;
  • a description of the principles underlying the operation of the man-machine terminals;
  • a general description of the dialogue procedures.

(The following points have been taken from CCITT Recommendation Z.331 [2].
— subscriber administration;
— routing administration;
— traffic administration;
— tariff and charging administration;
— system control operation.

If not covered by a separate command and print-out manual it is advantageous to issue the OMN with attached lists containing, e.g.
— an alphabetical catalogue of terms/headwords and abbreviations;
— definitions;
— error messages;
— MML inputs (commands), outputs, etc.

3.4.2. *Maintenance manual(s)*

The manual for corrective and, if necessary, preventive maintenance (MMN) specifies the activities of the operating personnel required:
— to keep the system in order;
— to ascertain and evaluate the prevailing system condition;
— to restore the normal state of operation.

As a consequence of the statement made above, the MMN should contain information to facilitate the execution of the following functions (general reference is made to CCITT Recommendation Z.331 [2]:
— maintenance of subscribers' lines;
— maintenance of inter-exchange circuits and associated equipment;
— switching network maintenance;
— control system maintenance;
— enhanced testing functions.

The maintenance manual does not attempt to provide detailed repair and maintenance information at slide-in unit level. (See the manual for repair and testing, § 3.4.7.)

3.4.3. *Engineering and ordering manual*

This manual needs further study. In drafting this section, at least the GAS 6 Handbook, Chap. VII, point 6.2 [1] should be considered.

3.4.4. *Installation methods manual*

The manual should detail all the necessary installation activities and the order in which they need to be executed.

Examples of such activities are:
— receiving and handling equipment;
— installation of racks;
— cabling;
— final assembly;
— inspection and installation test.

For each activity a description of the procedure should be provided, using diagrams where appropriate, together with information on tools, stores and documentation. Personal safety aspects should also be included.

When extending the scope of this manual (e.g. extension of exchanges, power plant installation) at least the following documents should be considered:
— GAS 6 Handbook, Chap. VII, points 4 and 6.3 [1];
— CCITT Recommendation Z.331 [2].

3.4.5. *Acceptance test procedures manual*

This manual needs further study. In drafting this section, at least the following documents should be considered:
— GAS 6 Handbook, Chap. VII, points 4 and 6.3 [1];
— CCITT Recommendation Z.331 [2].

3.4.6. *Command and print-out manual*

This manual should consist of two parts:
— the command list (CML) and
— the system print-out list (PRL).

3.4.5.1. Command list

The CML lists the complete set of MML commands provided for operating and maintaining the system. It should include an introductory part on which general information is given together with examples on command and print-out structure and syntax. In the main part of the CML, the MML commands themselves should be listed in respect of actions, objects, parameters and arguments. In addition to the listed commands, the CML may contain a list of error messages which are printed out in the event of unsuccessful commands being entered.

The CML is used by personnel whenever this type of information is needed, typically in conjunction with the OMN or the MMN.

3.4.6.2. List of print-outs

This list is for further study.

3.4.7. *Manual for repair and testing of equipment*
This manual needs further study.

4. **SITE-SPECIFIC DOCUMENTS**

In contrast to site-independent documents (see section 3.) the site-specific documentation contains information specific for a given exchange. As a rule the different documents are generated by using the data from the exchange planning and engineering process as input. The site-specific documents are needed for the installation, testing, commissioning and operation of an exchange.

4.1. **Detailed hardware documents**

The types and content of the site-specific hardware documents are partly system dependent. Therefore, no specific recommendations can be made. However, it is essential that a sufficiently detailed site-specific documentation is provided by the manufacturer/supplier.

To highlight the scope of information that is usually covered by the site-specific hardware documentation the following list of documents is given. The list is not intended to be exhaustive.

Type of document	*Essential content*
Labelling, marking and equipment numbering scheme	Explains the equipment identification codes and the schemes used, e.g. to specify the location: • of a slide-in unit within the module frame (shelf) and rack or • of a rack within the exchange room.
Exchange hardware catalogue	Lists the items required for the exchange installation.
Floor layout plan	Shows the space-related order of rack rows (suites) and racks within the exchange room/accommodation.
Cabling plan-list	Shows or lists the originating and terminating points/connectors of each cable within the exchange, specifies the type and length of the cable and the layout across the cable rack.
Functional address list	Lists the functional addresses of the exchanges' hardware items. This document should also contain the correlation between the functional and the local address of each item.
Rack layout plan-list	Shows the equipped rack with its voltage converters, module frames, control panels, etc.
Terminal assignment list	Allocates the functional items of the exchange to the pins of the distribution frames.
Cross connection list for distribution frames	Lists the cross connections (wiring) of a distribution frame.

4.2. **Detailed software documents**

For practical reasons site-specific software should be documented separately from site-independent software, although the types of documents are the same as described in § 3.3. and the same requirements apply.

4.3. **Exchange data**

Appropriate documents must be provided, which contain details of the information provided as site-specific exchange data.

The site-specific exchange data is usually contained in tables which are part of the site-specific exchange software and reside in the exchange's working storage.

Normally such tables exist for the automatic administration of exchange equipment, lines/subscribers and trunks.

Other tables are necessary to provide routing and charging capabilities and to make testing of equipment possible.

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References

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[1]   GAS 6 Handbook. *Choice of telephone switching systems.*

[2]   CCITT Recommendation Z.331. *Specification of the man-machine interface.*