# ISO 9001 QUALITY MANAGEMENT FOR THE OPERATION OF HYDRO-METEOROLOGICAL MEASURING NETWORKS

Dipl.-Ing. Gerhard Pevny[1], Dipl.-Ing. Werner Einsiedler[2] and Dr. Martin Mair[3]
[1] Logotronic GmbH., Phorusgasse 8, A-1040 Vienna, Austria, Tel: +43/1/5872971-14,
Fax: +43/1/5872971-41, email: gerhard.pevny@logotronic.co.at
[2] Verbund Austrian Hydro Power AG, Donaudorfstraße 8, A-3370 Ybbs, Austria,
Tel: +43/7412/52643-44442, Fax: +43/7412/52643-144442, email: einsiedlerw@verbund.at
[3] Central Institute of Meteorology and Geodynamics, Hohe Warte 38, Post Box 342,
A-1191 Vienna, Austria, Tel: +43/1/36026-2706, Fax: +43/1/3686621,
email: martin.mair@zamg.ac.at

***Abstract*:** Data of hydrometric and meteorological measuring networks influence a lot of decisions. It is therefore essential that these data, referring to measurement values are granted to be of high reliability. The International Standard ISO 9001 layouts different rules to make sure, that the features of products are according to the requirements of the customer and the basic product of hydrometeorological networks are measuring values. The optimal fulfilment of the user's requirements is called "quality" in the sense of ISO 9001. Logotronic has developed a basic ISO 9001 compatible process model for the operation of measuring networks. The model is based on the process modelling tool "PROMOL".
***Key words*:** Hydrometeorological networks, International Standard ISO 9001, objects, processes, prototype-process model, quality, quality-management, Standard's conformity

# ISO 9001 QUALITÄTSMANAGEMENT FÜR DEN BETRIEB VON HYDROLOGISCHEN UND METEOROLOGISCHEN MESSNETZEN

## Abriss

***Zusammenfassung*:** Daten von hydrologischen und meteorologischen Messnetzen beeinflussen viele Entscheidungen. Daher ist es notwendig zu gewährleisten, dass diese Daten, die sich auf Meßwerte beziehen von höchster Verlässlichkeit sind. Die internationale Norm ISO 9001 legt verschiedene Vorschriften fest, um sicher zu gehen, dass die Eigenschaften eines Produktes den Anforderungen des Kunden entsprechen und das grundlegende Produkt für hydro-meteorologische Messnetze sind Messwerte. Die optimale Erfüllung der Anforderungen des Anwenders heißt „Qualität" im Sinne von ISO 9001. Logotronic hat für den Betrieb von hydrometeorologischen Messnetzen ein ISO 9001 fähiges Prozessmodell entwickelt. Dieses Prototyp-Prozessmodell basiert auf dem Prozess-Modellierungstool „PROMOL".
***Schlüsselworte*:** hydrometeorologische Messnetze, Normenreihe, Normkonformität, Objekte, Prototyp- Prozessmodell, Prozesse, Qualität, Qualitätsmanagement ISO9001,

## 1. Why quality management at measuring networks?

Hydro-meteorological networks are collecting data which are subsequently used for the preparation of significant decisions within politics, planning, emergency management and many other domains. Some examples to mention would be the design of water-constructions, flood alarming management, avionics meteorology, storm warning .....

It is therefore essential and normally expected, that the network operator's "product" should be of high level "quality". The main "product" of measuring network operators thereby are correct measurement values which, registered comprehensibly, are transferred to the measuring network centre and processed in order to submit the required information.

Within the International Standard ISO 9000 the term "Product Quality" means that the expectances of the customer and the features of the product should cover as much as possible.
The "customers" of a hydrometeorological network are of course all those people, who use the collected measurement data and the derived information within their own area of operation.

In future these historical tasks will even be enlarged with additional requirements. Factors like operating efficiency, competition, flexibility and innovation will get more and more important and will give a competitive edge to all those, who are capable to fulfil the more advanced

requirements. Additionally clearly defined requirements, particularly requirements referring to quality, will give way to privatisation of measuring networks in the future.

**2. The International Standard ISO 9000**

Quality management according to International Standard ISO 9000 offers an ideal basis to private corporations, meteorological institutes and even to public authorities (hereafter called “organisation”) to organise quality assurance of their products and services and even to improve and develop their facilities continuously as organisation. The systematic of a so called "Improvement Cycle" in the meaning of ISO9000 shows Fig. 1.

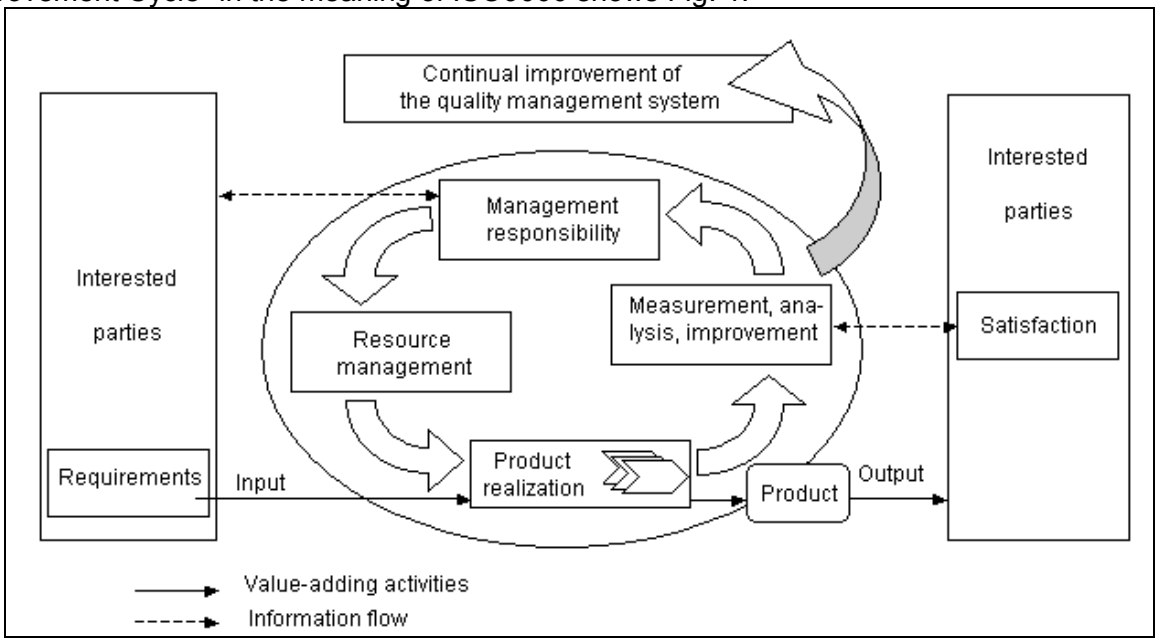


*Figure 1: ISO 9000 systematic*

The view of the organisation as a whole system is essential. To assure the correctness of results, reliability and repeatability of measurement values etc., as well as quality assurance of products and services, normally do not depend on single actions. Those are the results of a well planned, correct and secure co-action of the whole system, namely the quality management system of the above mentioned organisation.

The mechanism of such a system of course normally differs in between the branches. In that project “QM for the operation of hydro-meteorological measuring networks”, common principles and necessities regarding these requirements in accordance with the International Standard ISO 9000, were collected and worked out in detail.

The International Standard ISO 9000 with its central document ISO 9001:2000 “Quality Management Systems – Requirements” leads far beyond the definition of some single requirements. It enables a global management of the whole organisation and is therefore a real tool to manage this organisation or only some parts of it. This has always been the basic idea behind ISO 9000 Standard, but it was only made possible with the version 2000, when focusing the view on all business-cases in terms of so called “business processes”. Introducing this feature it was given way for common and unrestricted use. It was said that the pre-version dated 1994 somehow showed a partial tendency to production enterprises.

The standard regulates how business processes are to be defined, documented and fulfilled, how they should be supervised and be capable to improve the whole system, always aiming at continuos improvement. The whole system always includes both the vision and objectives of the management as a "Strategy Model", as well as the justification on fulfilling customers’ requirements.

Once the organisation has implemented the requirements of the Standard and practises it according to its definitions demonstrably, it is possible to achieve a certificate stating –“certified according to International Standard ISO 9001:2000”. This certification not only guarantees an internal benefit and secureness to the organisation, but also the high grade of quality and reliability is visible to extern partners.

## 3. Initial point

Within this project Logotronic – itself certified according to ISO 9001:2000 – has defined the goal to develop a product, which will be able to fulfil the Standard's requirements for measuring network operators practicably within meteorology and hydrology demands, and even supports its implementation. This project was realised in co-operation with the Central Institute of Meteorology and Geodynamics in Vienna and Verbund Austrian Hydro Power AG as well as with Mr. Albert Schwarz of Dr. Lürzer Consulting, who also developed a supporting software-solution.

The tasks required were clearly defined: Applying the common requirements out of ISO 9000:2000 on to concrete requirements of measurement network operation and finding its solutions, which in consequence should be represented in a "Prototype-Process Model".

It was required not only to look at the subject one-dimensional from the Standard's point of view, but even more to combine the Standards requirements with the measuring network operators' operational experiences and to formulate a practical model.

Thereby it was quite important to avoid disadvantages like high administrative expenses and any additional burden, which often are said to relate to Standard requirements. Thus a prototype process model for specific sequences within meteorological and hydrological measuring networks was created, which represents an ideal platform to organise an individual system for network operators and additionally gives way to establish an ISO 9000 compatible quality management system.

## 4. The prototype process model "measuring network operation"

Initially the basis for each QM-system is the so called "process model". Thereby all business cases of the organisation are separated and described first into single business processes and further on broken down into single process steps. This can be applied as long as estimated to be necessary and reasonable. The most important business processes form the highest level within the so called "Main-Process Model" in terms of access to the QM-system itself. (Fig. 2)

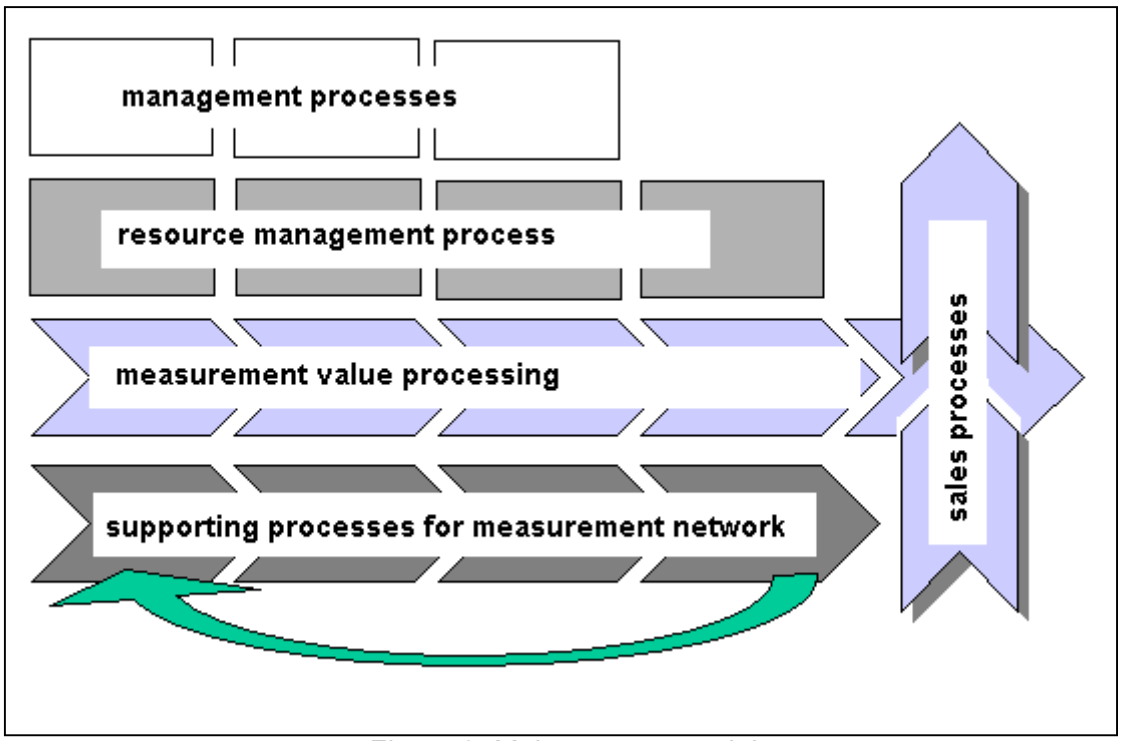


*Figure 2: Main-process model*

Beside the processes the following terms are relevant within the process model:

- Supporting objects:
  All elements which are necessary to perform the single business processes, like for instance questionnaires, check lists, IT-tools, operating resources etc.
- Company organisation structure:
  Definition of the structure of the company organisation (organigram). Definition of single departments defining the responsibilities for performance of the single process steps within the company organisational structure.

These processes, objects and responsibilities are managed separately in this developed process model. The implementation of the process model and all its belonging definitions were realised by using the process-modelling-tool ®"PROMOL".

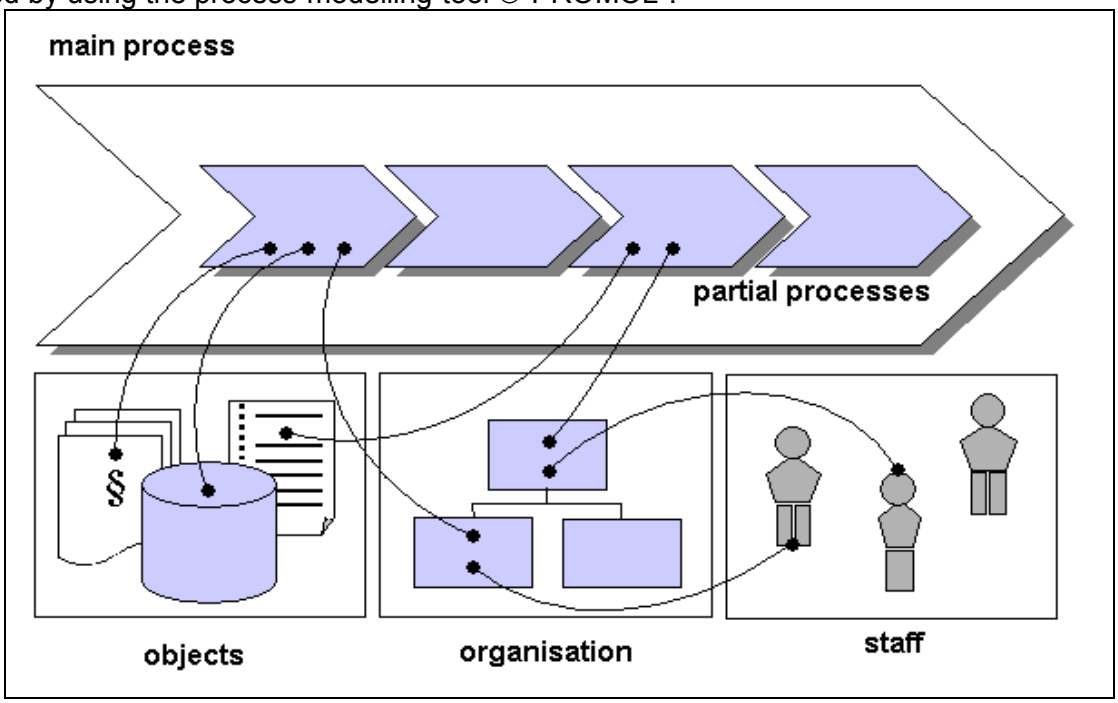


*Figure 3: ®PROMOL-methodology*

The links between the single elements of the process model are defined in a relational data base. The basic links shows Fig. 3. This method avoids to have to manage many single documents out of word processing programs but manages a single model on the whole, which prevents getting data redundancies. Each information is stored on a certain place within the process model and may be altered at this place only. One of the specific features of the process modelling ®PROMOL is, that out of the relational data-base there can be generated a Web-model automatically, lets say "pushing a button", which is able to present all information by Web-compatible html-pages. Processes and objects may be "clicked on". Once the relations of the elements within the data base are fixed, they keep obtained and are converted into hyperlinks in order to be able to "surf" through the defined business processes. To use this "Web-model" it is only necessary to have available a Web-browser as software-tool. Thus a "paperless" QM-system is developed.

By using this method full transparency is achieved to know which activities are done, as well as how, wherewith and by whom they are done. The use of this Web-model requires nearly no PC-resources and is also capable to run without a network, for instance from Compact Disk. This feature enables it to run without restrictions also during field work. Even paper documents may be generated data base supported. Each employee – being in the office in front of the PC, or at field service at the station, as well as being just mobile – is capable to recall the actual descriptions of his tasks and has got available all actual versions of documents, like formulas and check lists. This is an essential precondition for save processes.

Here some examples that show, that in many cases clear information can be obtained also on complex matters:

1. Identification of possible effects on the business processes due to changes in the staff.
2. Assessment of influences from outside on the business process (changes in customer requirements, measuring methods, changes in the basic measurement network requirements)
3. Merging and splitting of organisations and parts of organisations

**5. Checking the prototype process model on the Standard's conformity**

The Standard defines that organisations using a QM-system are able to achieve an internationally valid certificate, which confirms, that the organisation's quality management system fulfils the Standards requirements according to ISO 9000. The check, if such a certificate is to be awarded, is a certification audit. Such audits are performed by certification companies. An audit always consists of two parts.

Question 1: Does the documentation of the business processes fulfil the requirements of the Standard? (verification of documents)

Question 2: Are these specified business processes really performed within the organisation?

Because within the actual project only the prototype process model is available, the answer on above mentioned question 2 is not applicable. Anyway the prototype process model will then be a subject to investigation by the audit body, performing a so called "verification of documents".

The confirmation that all described processes are according to ISO 9000 means for the operator, who establishes an own QM-system, that the Standard's conformity is automatically granted when using the prototype process model. An essential saving of costs should be the result when introducing quality management.

**6. Prospect**

Why did just Logotronic as a manufacturer of hydrological and meteorological measurement systems engage in such a project?

Initially due to the well defined and comprehensive procedures in the measuring network, it is also possible that the quality of the measuring instruments installed is judged objectively by the network operator. Logotronic's own quality demands therefore become objectively revisable within its practical usage at the customer. Furthermore while using most advanced technology in the measurement stations as well as in the measurement network, new functionalities may be implemented. Essential parts having been defined within the QM-process model are supplied by the measuring instruments by themselves. The objective to achieve a widespread automation for necessary QM-processes is therefore a basically and future principle of the development of

Logotronic products. The QM-system and its suitable technology will therefore be offered as a product-package belonging together.

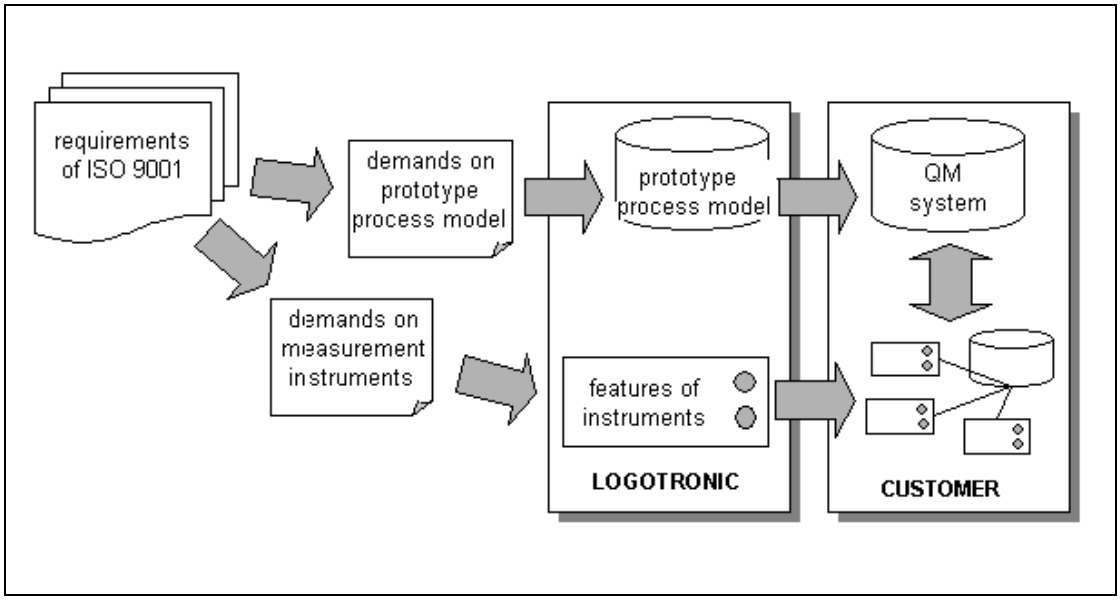


*Figure 4: QM-system and instrument technology as a complete package*

Example: The re-calibration of a sensor at the measuring station will be registered automatically by the station- manager (datalogger). The measurement system automatically stores all QM-relevant additional information like user-identification, date, time, previous and actual calibration coefficient, measurement values which were used for calibration ..... These data, together with the measurement data, are transferred to the network-centre and there automatically processed and stored accordingly.

The presented prototype process model will be put into operation at a test installation within the forthcoming months at a big measuring network operator and there be tested on its practical efficiency. Based on this practical experience a fine adjustment will take place. Thereby however it is considered not to reduce the universality of the prototype project model.

**7. References:**

(1) ISO, International Organization for Standardization, ISO 9000:2000

(2) ®PROMOL, Process modelling tool PROMOL, registered trademark of Dr. Lürzer Software KEG

(3) WMO, World Meteorological Organization, Guide to Meteorological Instruments and Methods of Observation, Sixth edition, WMO-No. 8