KKS-Application Explanations

Part B Engineering Discipline-Specific

Part B4 Identification of Instrumentation and Control Tasks/Functions in Process Systems and Identification of Functions in Instrumentation and Control Systems

KKS- Identification System for Power Stations

VGB-B 106 B4 E

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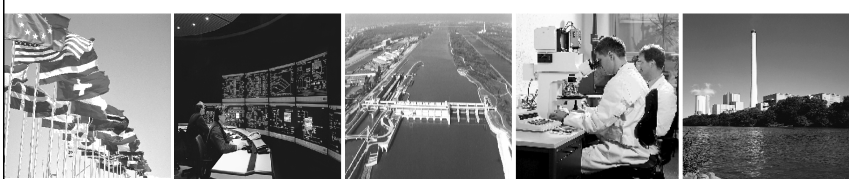


Preface to the KKS Application Explanations, issue 2004

With the edition 2004 the layout was adapted on the form used by “VGB PowerTech Service GmbH” since the year 2000 and the text of the Application Explanations **B 106** was converted to standardized electronic formats.

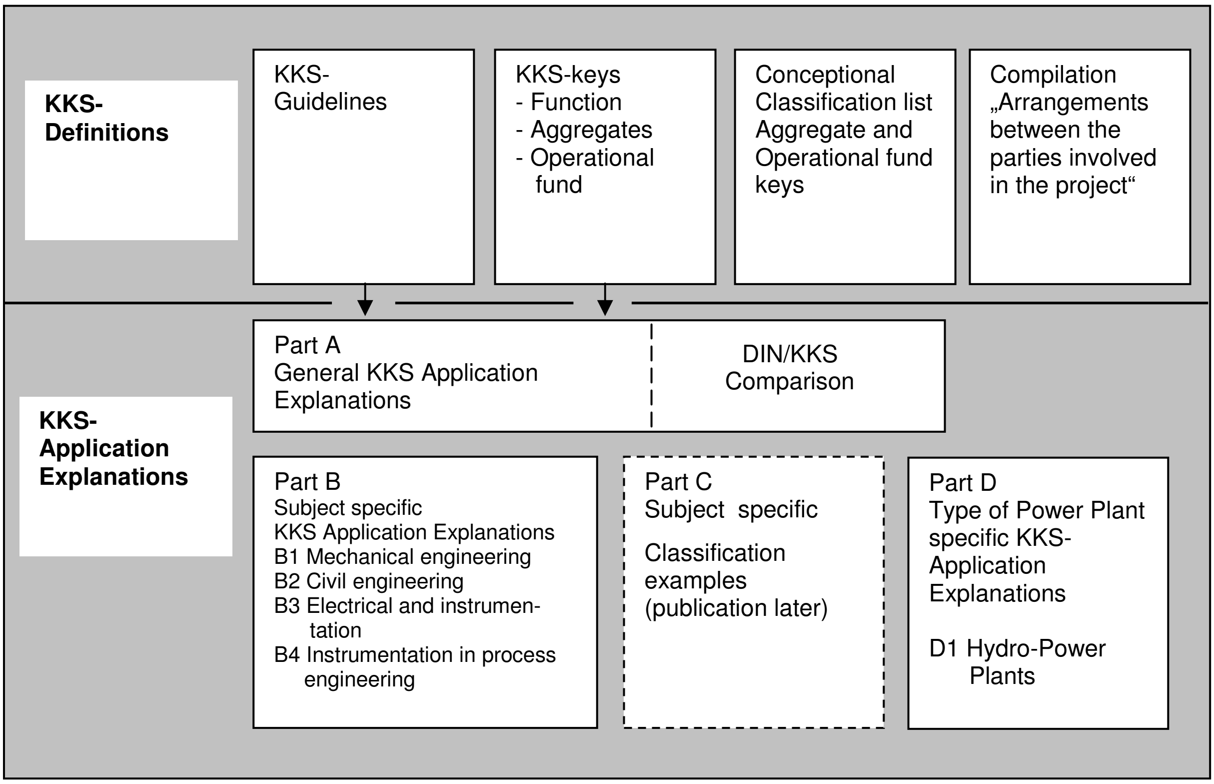
The VGB Technical Committee “Technical Classification Systems”, often specified in the “KKS Application Explanations”, became to the Working Panel “Reference Designation and Plant Documentation” due to the structural changes of VGB in the last years.

A project team, specially installed by the Working Panel, provided also the "KKS Application **Explanations** for Hydro-Power Plants" which was published in the year 2004. These specific Application **Explanations** of Hydro-Power, published as B106 D1 supplement the existing explanations around the special interests of the Hydro-Power plants and create the basis for a more efficient engineering and project completion in this field of activity.

Correct application of the KKS is the condition that unique identification and rational function in the desired measure is reached. The Application Explanations are supplements to the KKS Guidelines and are intended to give assistance in use of the identification system.

Following overview shows the connection between the KKS Definitions and KKS Applications.

Essen, in September 2004



Contents

Preface to Part B4

The KKS guidelines provide few rules for Instrumentation & Control. More detailed rules are therefore always defined company or project-specific, e.g. for signal codes.

In addition, certain identification problems cannot be solved with the current KKS guidelines. For Example, dedicated electrical and I&C equipment supplied by the component manufacturer ("black box equipment") for cranes, compressors, etc. is difficult to integrate in the overall I&C identification system without changing the associated codes.

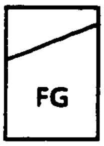
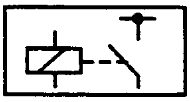
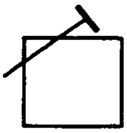
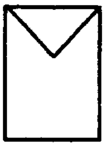
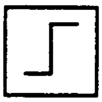
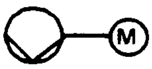
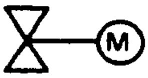
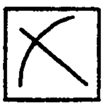
With the new DIN draft standard V6779 T1, Sept. 92, a general solution to these problems will be provided. However, KKS will not be adapted correspondingly until this DIN standard has been accepted by IEC and ISO, thereby providing a basic international identification standard. This adaptation will also involve the inclusion of more detailed KKS rules for Instrumentation & Control.

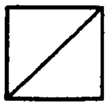
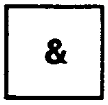
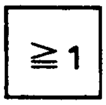
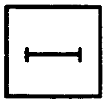
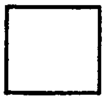
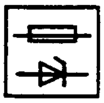
The current version of Part 4 is therefore only a compilation of company and project specific examples with no claims to completeness or general validity.

1 Introduction

No claim to general applicability is made for the Examples chosen here, nor are the representations and format of the identifiers or the chosen symbols generally binding. Some terms are also handled differently in specific companies and projects.

The drawings which follow will use the symbols shown here:

Symbol	Explanation
	Open-loop control, e.g., AS = control interface FG = functional group control
	Switchgear branch feeder for an electrical load
	Setpoint adjuster
	Controller
	Limit value monitor (binary signal derived from analog signal)
	Operator control tile, e.g., for pump or solenoid valve
	Pump with motor
	Valve with actuator
	Measuring point, for temperature
	Measuring point, e.g. pressure, distance
	Indicator
	Signal lamp
	Alarm list

Symbol	Explanation
	Transducer
	Binary AND
	Binary OR
	Time element
	General processing function (the type of processing must be given in the symbol, e.g., 2-out-of-3, MAX value gate, etc
	Analog distributor board (with fusing and decoupling)

1.1 General

Since 1978, the Identification System for Power Plants has been developed and implemented in many fields to standardize identifiers in process systems. This system permits the identification of both process plants and sections of plants and associated electrical and instrumentation and control equipment as well as their point of installation or location.

Process operation and monitoring by the operator is simplified by a high degree of process transparency which makes clear the interrelationships between the instrumentation and control, and the process equipment. This transparency is ensured by the rules below for identification of the overall system.

A brief definition is provided to standardize terms:

Process engineering sets engineering tasks for I&C for its various processes. I&C monitors the fulfilment of these tasks, actively intervenes in the process as required and provides information and possibilities for intervention by the operators.

I&C equipment (devices) must be implemented locally (hardware) to fulfil this task. This equipment is assigned point of installation identification, see Application Commentaries Part B3, or location identification, see Application Commentaries Part B2, in addition to the process-related identification.

The associated rules and examples are not the subject of the present application commentaries, therefore no further details are given here.

The instrumentation and control equipment already mentioned performs instrumentation and control functions (measurement, open and closed-loop control, monitoring) to fulfil the set tasks.

These functions are also identified by KKS in the same way as for the process systems to increase the transparency of the instrumentation and control and to simplify manual process control and monitoring.

This system code for process-related identification will be discussed below; the additional identification.

The problem of identifying I&C equipment with its various functions is presented schematically in Example 1.1/1. A hierarchical structure for a control system is shown. The significance of the terms is as follows:

Control interface	Logic necessary for actuating the drive, e.g., enabling release, interlock, protection.
Subloop control	Special logic upstream control interface, e.g., changeover, sequence selection, etc.
Functional subgroup control	Automatic control, inclusive of all required command signals for the associated supporting equipment for a main component (e.g., feedwater pump). If there is no difference between this and a functional group, this term is not used.
Functional group control	Automatic control programs which can intervene on several similar functional subgroups, e.g., pumps within a single plant section and that have higher-level control tasks, e.g., load-dependent pump startup and shutdown.

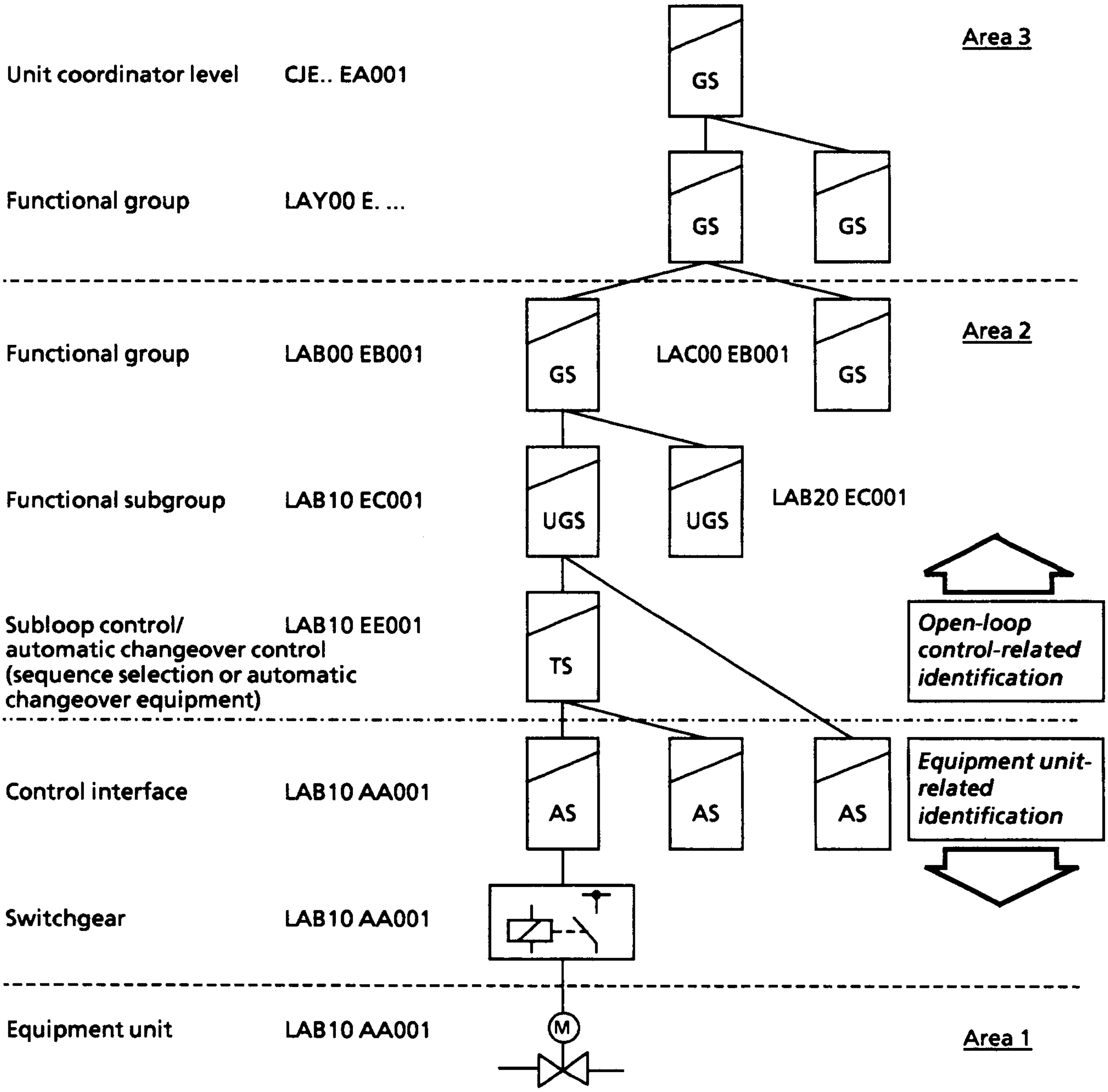
The process system is located in area 1.

Area 2 in the sketch is clearly limited to I&C equipment allocated to process systems. The process-related system code is inserted in the first identifier places on breakdown level 1, thus permitting the relationship to be seen.

For I&C equipment which act on more than one process system, the dominant system can be identified on breakdown level 1 (area 3), or data character F_2 or F_3 is replaced with a globally valid *Y*. The process system relationship is no longer recognizable for control levels. General control identifiers are used here; for example, the use of *GE* is recommended.

The identifiers given at the equipment unit code level are illustrative only; more exact information can be found in the examples.

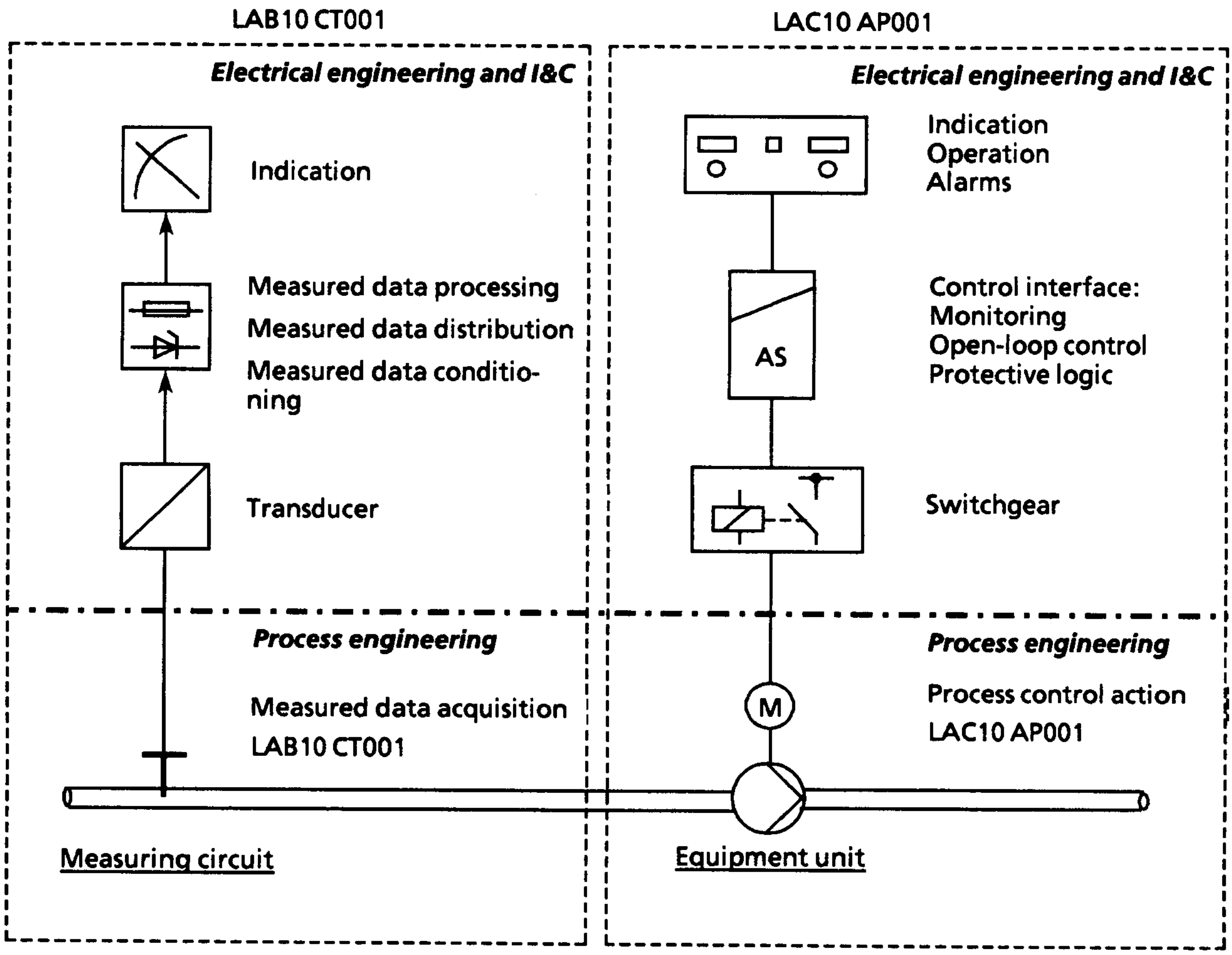
Example 1.1/1: Overview of subdivision of an I&C system (in the example, an open-loop control).



1.2 Identification of Instrumentation & Control with Functions Allocated to a Single Process System (Subject of Section 2)

The identification of I&C equipment for process engineering is particularly important, as the engineering relationships are encoded in the type of identification. The basic principle of this identification is to employ the codes for plants, sections of plants, systems and equipment units for Instrumentation & Control as well in cases where I&C equipment is provided for the corresponding process plant sections. This means that identification is based on the system codes assigned by the process engineer (see Example 1.2/1).

Example 1.2/1:

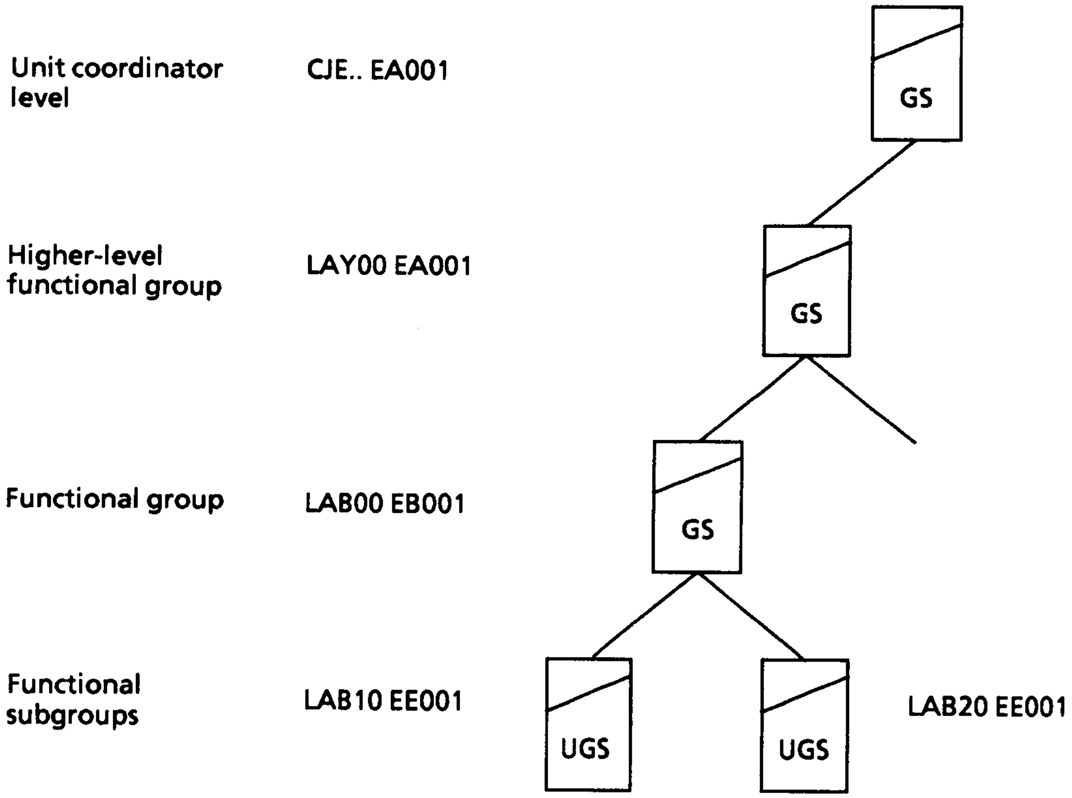


As the figure shows, the equipment and signals for the measuring circuit retain the system and measuring circuit code. All control equipment for an equipment unit is likewise identified with the same code as for the equipment unit at the system code and equipment unit code. The coding philosophy is explained in more detail in Section 2.

1.3 Identification of Instrumentation & Control with Functions Allocated to More than One Process System (Subject of Section 3)

If the relationship to a single process system, subsystem or equipment unit is no longer present, higher-level codes are allocated to identify the corresponding higher-level functions by the type of coding (see Example 1.3/1).

Example 1.3/1:



This figure shows that the hierarchical structure of the Instrumentation & Control automatically results in changes to the higher-level KKS codes due to grouping into higher level areas, as will be shown later in further KKS examples. See Section 3.

1.4 Identification of I&C Equipment

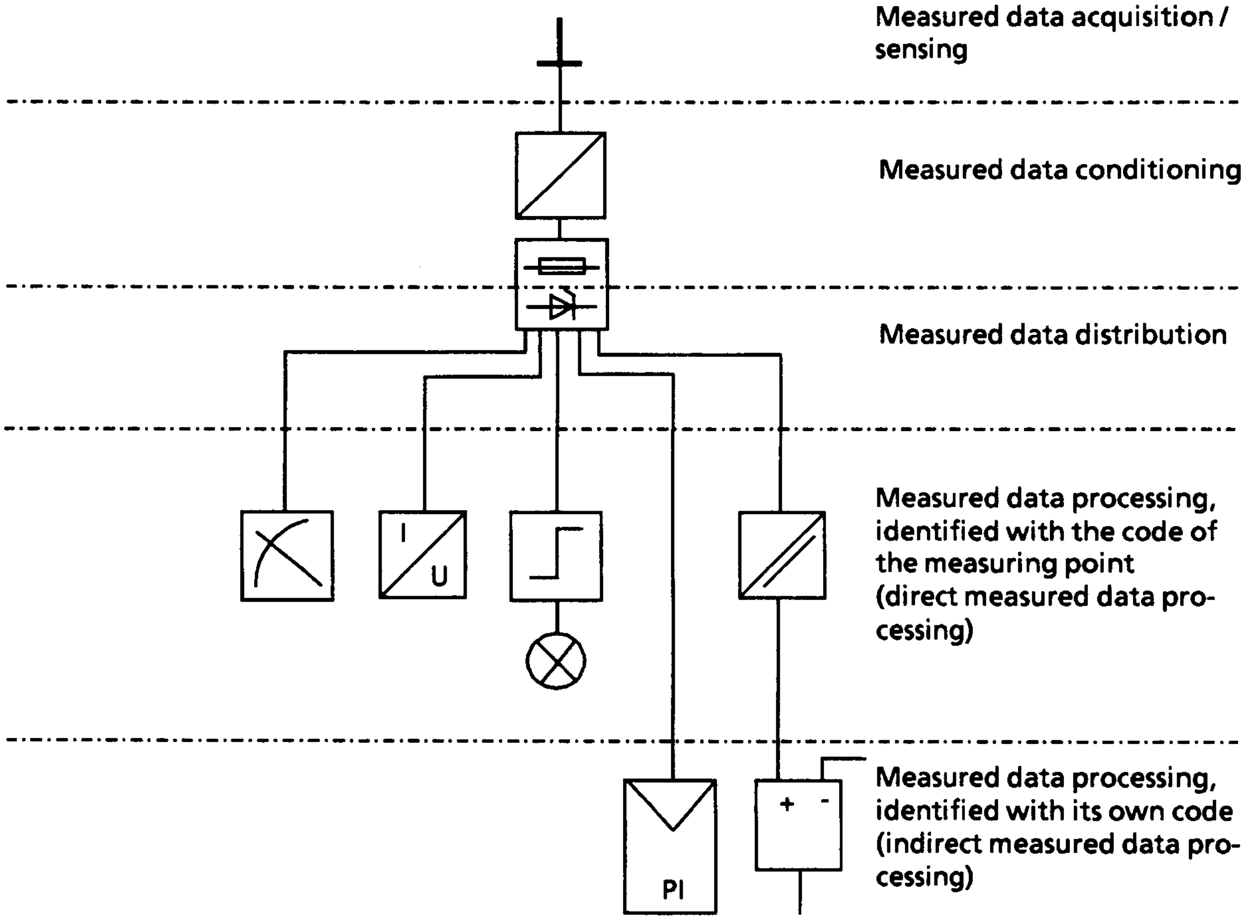
Special conventions are used to show relationship between process engineering and the associated I&C equipment. All process measured data and the I&C signals derived from these measured data are identified at the system, equipment unit and component code breakdown levels and indicate the relationship with I&C signal processing. This is explained in further detail in the sections which follow.

2 Identification of Instrumentation & Control with Functions Allocated to a Single Process System

The basic signal types are analog signals with values between 0 and 100% of the signal range and binary signals which can only take on two states (signal present or not present).

The following example serves to explain the I&C processing functions.

Example 2/1:



Section 2.1 describes the subsystem for measured data acquisition/sensing, conditioning, distribution and processing, with these functions all assigned the same code as the measuring point. Processing functions which have their own code are described in Sections 2.2 to 2.5.

2.1 Measurement (Measured Data Acquisition, Distribution and Processing)

2.1.1 Types of Measuring Circuits

Measuring circuits comprise measured data acquisition, conditioning, distribution and direct processing. KKS distinguishes between direct measuring circuits, the measured data for which come from physical parameters measured on the plant system and subsystems, and indirect measuring circuits, whose measured values are obtained by calculation and/or combination of "raw data" and therefore must be identified in a different way.

Measuring circuits on equipment units (e.g., checkback signals for a control interface module) represent an exception. These measuring circuits are not separately identified. Details are given starting in Section 2.1.2.

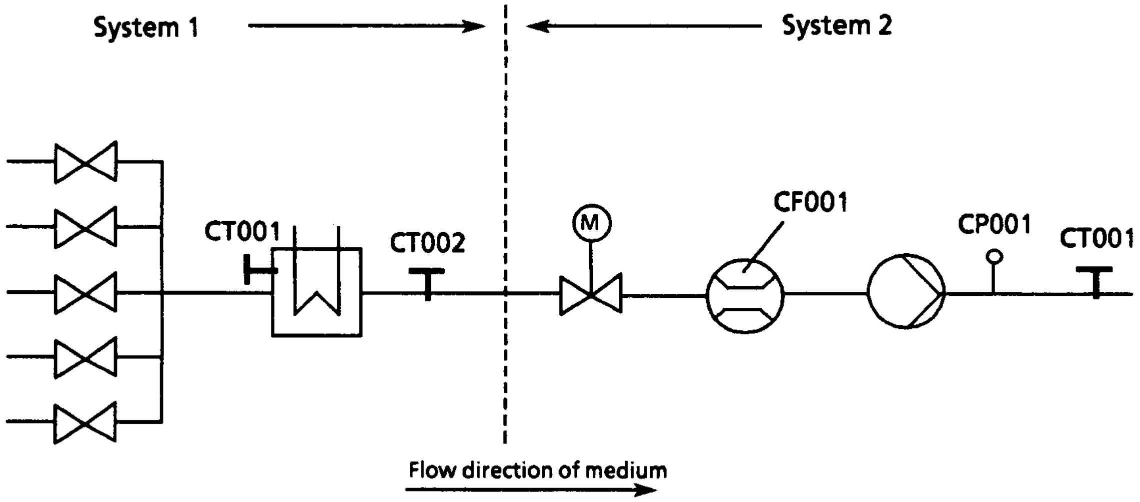
2.1.2 Identification of Measuring Circuits

2.1.2.1 Identification of Direct Measuring Circuits

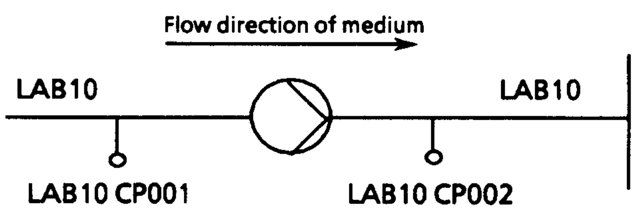
Direct measuring circuits are identified in data character A_1 on breakdown level 2 by a *C*, denoting a direct measuring circuit and by the measured physical parameter (e.g., pressure, temperature) in A_2 in compliance with DIN 19227.

Measuring circuits are identified on breakdown level 1 by code for the system section in which the analog transmitter is located, i.e., measuring circuits are identified by the code for the system within which the analog transmitter is installed.

Example 2.1.2.1/1:



Example 2.1.2.1/2:

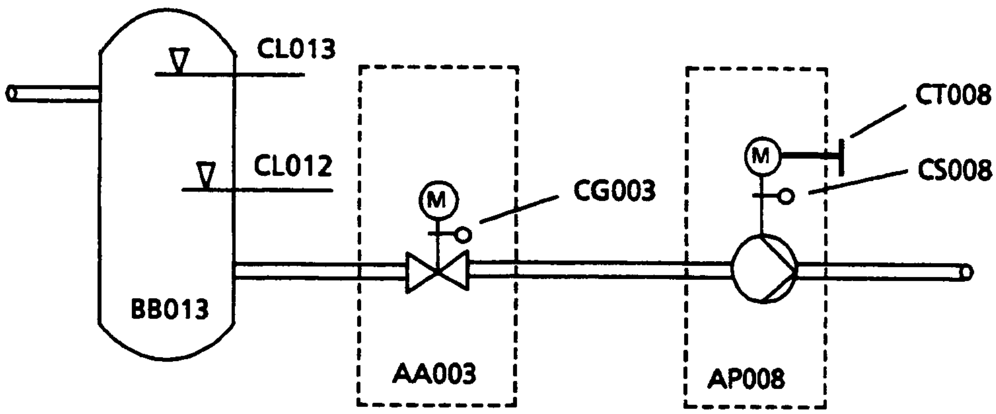


The data characters in A_2 are governed by the measured physical parameter and not by the measurement principle.

Measuring circuits for the same physical parameters within individual systems identified in F_N shall be numbered in ascending order in A_N in the direction of mass and energy flow. If new measuring circuits are added or existing ones deleted, measuring circuits which have already been identified are not to be recoded as a result of this.

As measuring circuits are generally[1] always assigned a separate measuring circuit identifier at the equipment unit code breakdown level, measurements on identified equipment units are identified as separate measuring circuits and not with the same code as the equipment unit. This includes measuring circuits, for example, for tank and vessel liquid level, analog valve lift, speed, motor winding temperature.

Example 2.1.2.1/3: Separate identification of measuring circuits on equipment units



This example shows measuring circuits on the individual components of the system represented. The level measuring circuit on the tank is not identified with the same code as the tank but rather as a separate measuring circuit. The motor speed and temperature measurement are likewise identified as separate measuring circuits. The same holds for the analog valve lift measurement.

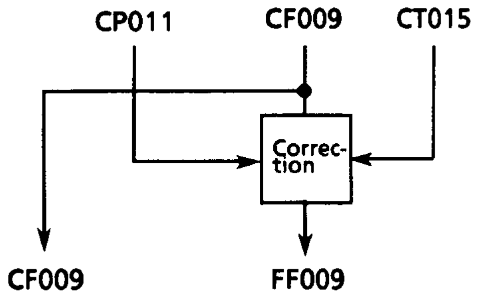
Appropriate coding of the measuring circuit in A_N makes it possible to also designate the equipment unit on which the measurement is performed (e.g., valve AA003 with additional lift measuring circuit CG003).

[1] Exceptions see Section 2.1.2.3.

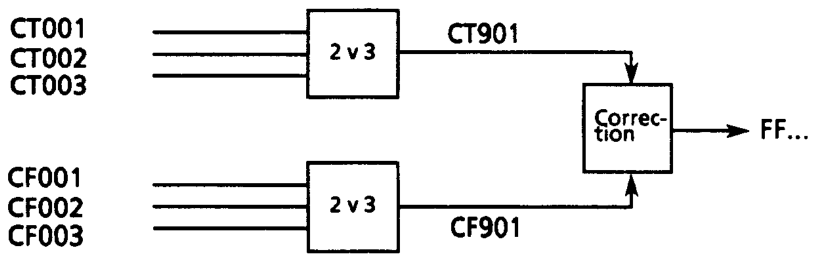
2.1.2.2 Identification of Indirect Measuring Circuits

In contrast to direct measuring circuits, indirect measuring circuits do not acquire physical parameters directly but rather determine calculated and/or corrected measured data with the aid of measured values from other measuring circuits. The signal is not obtained directly from an analog transmitter located on a process system, but is generated with the aid of additional calculation rules. The resulting new measured data or signals form a new or different item of information. These measured data and the associated I&C equipment are differentiated from direct measuring circuits by identification with *F* (indirect measuring circuit) instead of *C* in data character A_1. As for direct measuring circuits, data character A_2 is a code letter corresponding to the physical parameter (DIN 19227).

Example 2.1.2.2/1: Pressure and temperature corrected flow measurement using the raw measured data

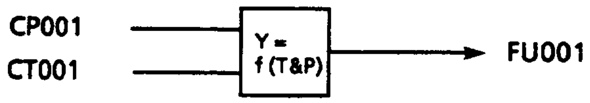


Example 2.1.2.2/2: Temperature corrected flow measurement using redundant measured values input via 2-out-of-3 logic

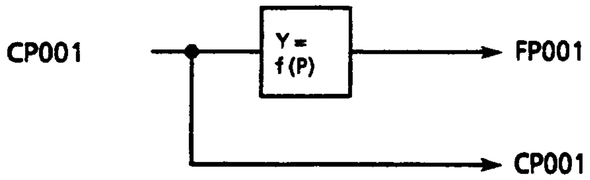


Gated analog signals linking physically dissimilar direct measured variables are identified by means of a *U* in data character A_2 (to denote gated and other miscellaneous types of variables).

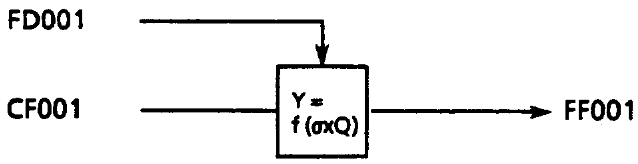
Example 2.1.2.2/3: Formation of calculated signal from 2 changing measured values, e.g., enthalpy



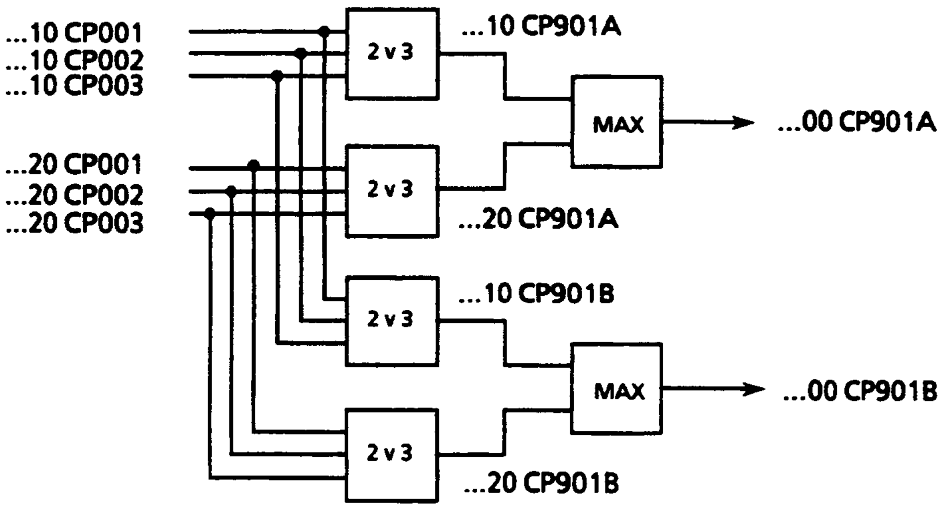
Example 2.1.2.2/4: Formation of calculated signal from one changing measured value, e.g., limit curve



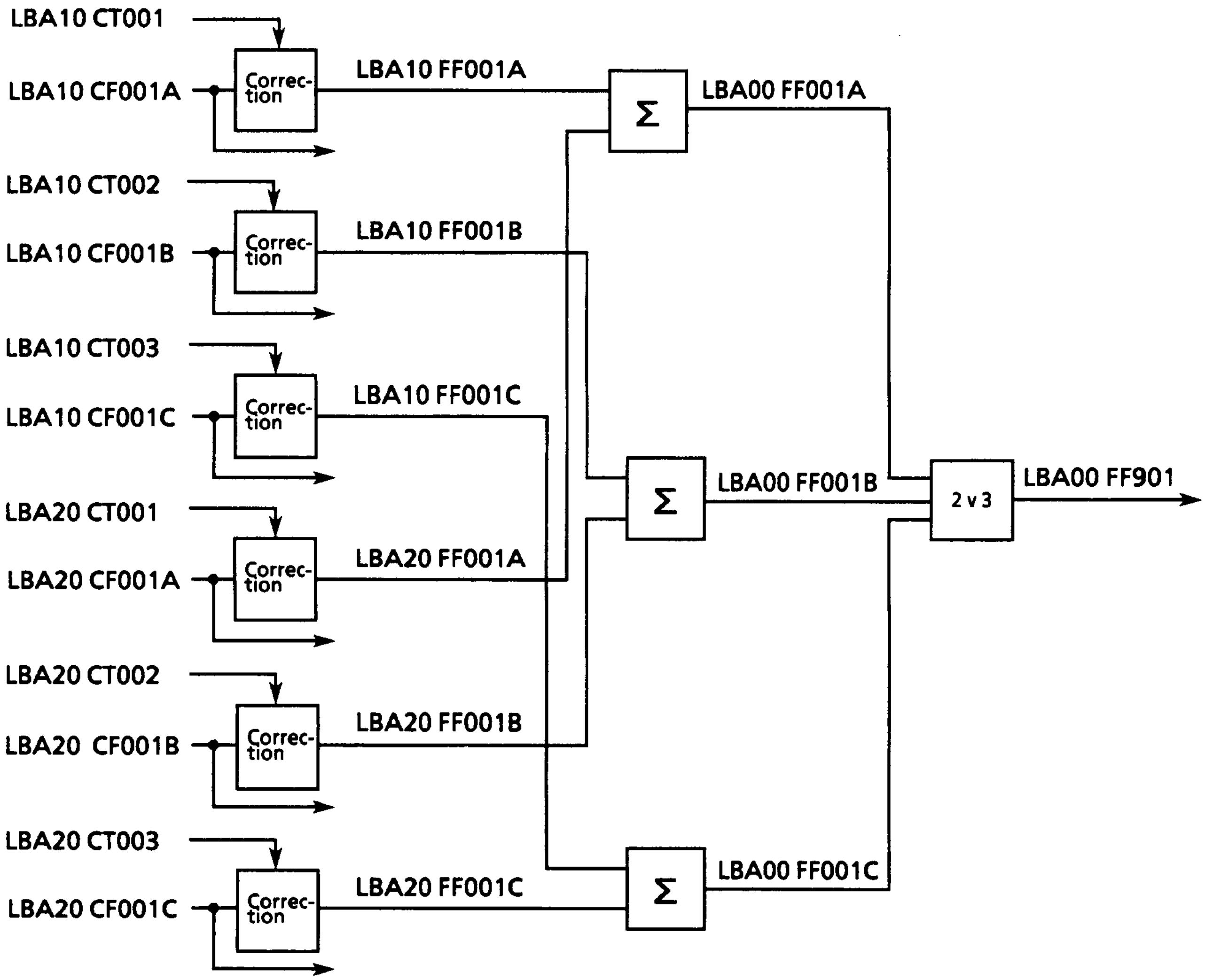
Example 2.1.2.2/5: Formation of calculated signal from 2 changing signals, where the input is one measured value and one calculated value, e.g. density-corrected flow



Example 2.1.2.2/6: Formation of 2 output signals via MAX logic from 2 groups of 3 measured values connected via selection logic, e.g., for two-train HP steam systems



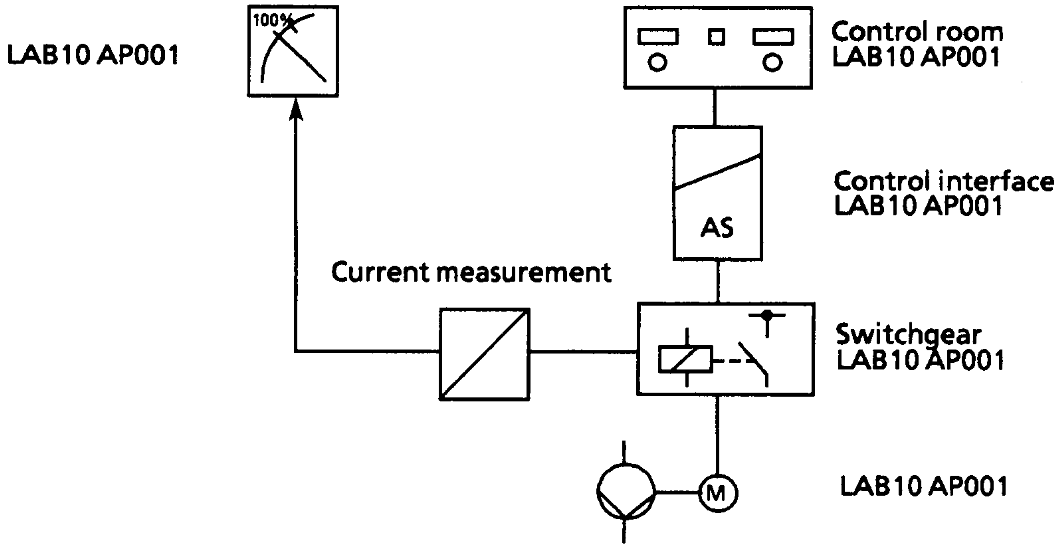
Example 2.1.2.2/7: Formation of an output signal via selection logic, where a sum is first formed from measured values from two systems. Each system consists of a flow measurement with 3 analog transmitters at a single measuring point with separate measuring points for correction. For example, for formation of protection criteria in two-train HP steam systems.



2.1.2.3 Equipment Unit-Related Measuring Circuits

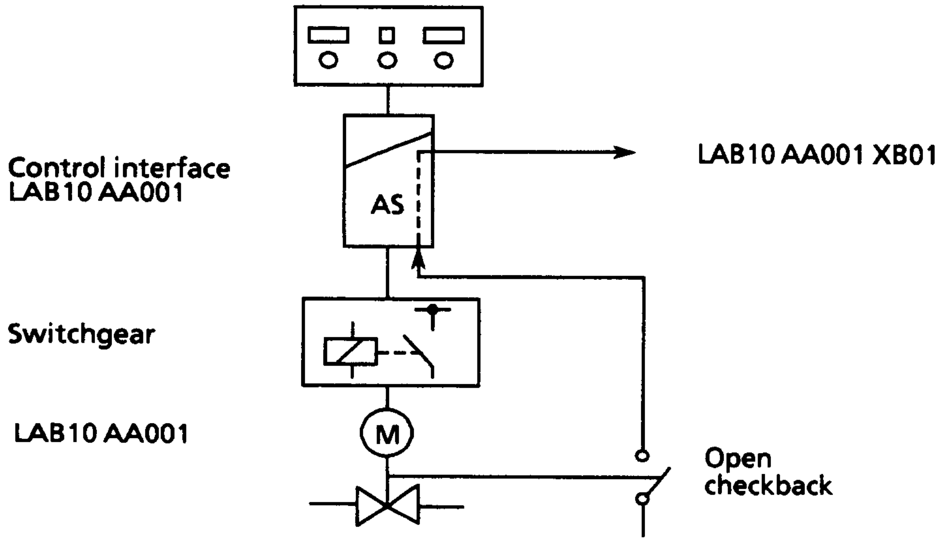
Equipment unit-related measured data processing comprises that electrical and I&C equipment which is only associated with a single equipment unit. Examples include control interface, protective logic, feeder measurement (switchgear), final control element command termination. This measured data processing is generally assigned the same identification as the corresponding equipment unit and hence does not have a separate measuring circuit code.

Example 2.1.2.3/1:



The current measurement equipment is required to indicate the equipment unit load in %. No seperate measurement circuit code is assigned to this.

Example 2.1.2.3/2:



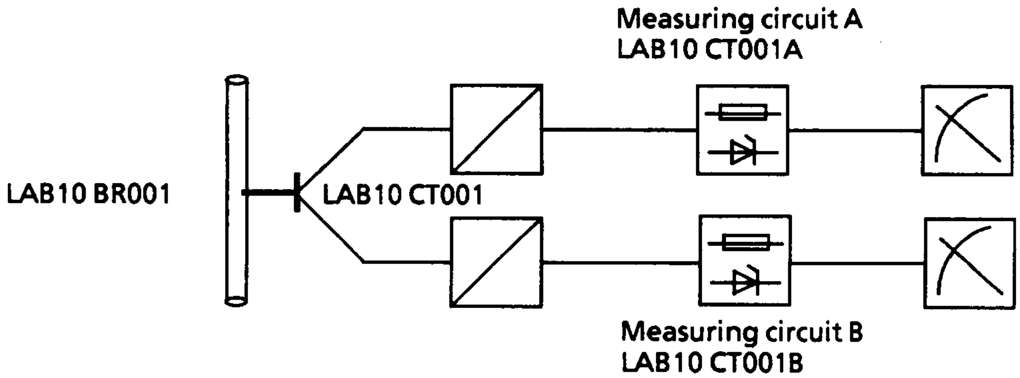
Measurement of valve limit position is used for a number of purposes, these including actuator command termination via the control interface. No separate measurement circuit code is assigned to this.

As the two examples show, all other I&C equipment (including signals) associated with the equipment.

2.1.3 Measuring Circuits with Multiple Taps at a Single Measuring Point

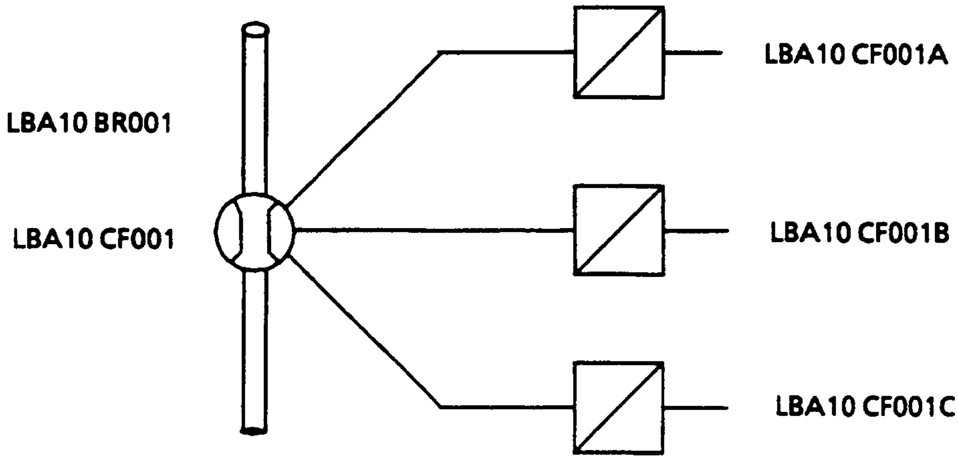
Multiple measuring circuits associated with a single measuring point (analog transmitters) are differentiated at the equipment unit code by the additional data character A_3. This includes all temperature measurements with duplex thermocouples, flow measurements with multiple taps as well as measuring circuits connected to multiple-core current or voltage transformers.

Example 2.1.3/1: Temperature measurement with duplex thermocouples



In contrast, if the sensor is a duplex thermocouple for which only one connection is used for measurement (second connection as a spare), only one measuring circuit code is allocated and data character A_3 is not used.

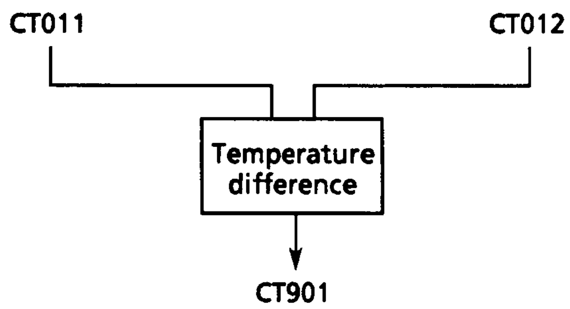
Example 2.1.3/2: Measuring circuit with multiple taps



2.1.4 Logic Gating of Measuring Circuits

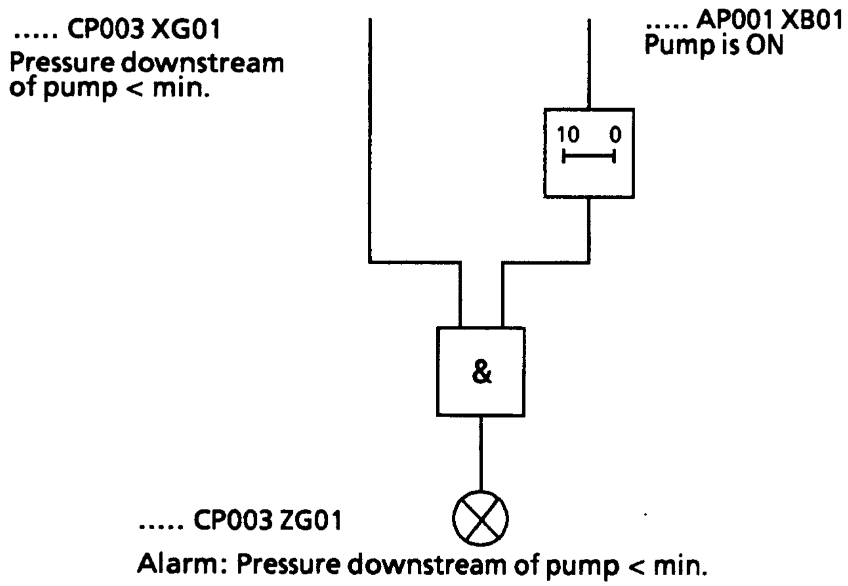
As a general rule for signal gating, the identifier of the signal to be processed and hence the physical parameter is retained in the identifier as completely as possible after logic gating. Gated analog signals that link physically similar direct measured values are identified by means of a set number, (e.g., "9") in the first data character of A_N and retain the code of the physical variable in data character A_3.

Example 2.1.4/1: Formation of a temperature difference signal



Where signals are used to limit or suppress the original measured data, the processed output signal retains the measuring circuit code of the original measured data, only the prefix symbol of the signal identification is being changed from *X* to *Z*.

Example 2.1.4/2: Suppressed alarm



2.1.5 Analog Signal Processing

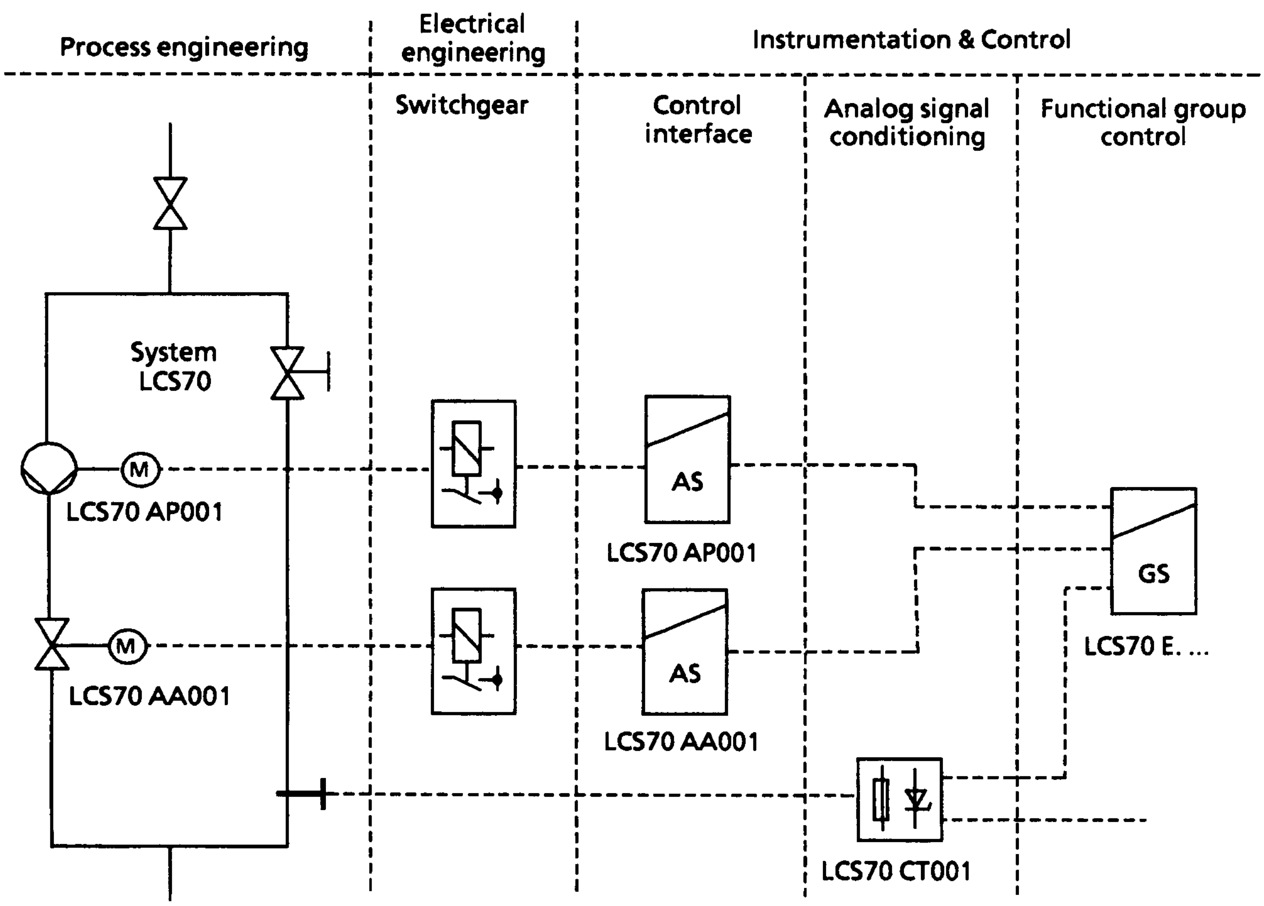
Analog signal processing within systems separately identified on the function level.

Analog signal processing elements comprise gates between more than one measuring circuit and/or equipment unit-specific analog signal processing elements for systems such as open-loop controls (but not control interfaces). They encompass the instrumentation and control equipment for more than one equipment unit and are identified on breakdown level 2 by means of A_1 = *E* (analog and binary signal conditioning).

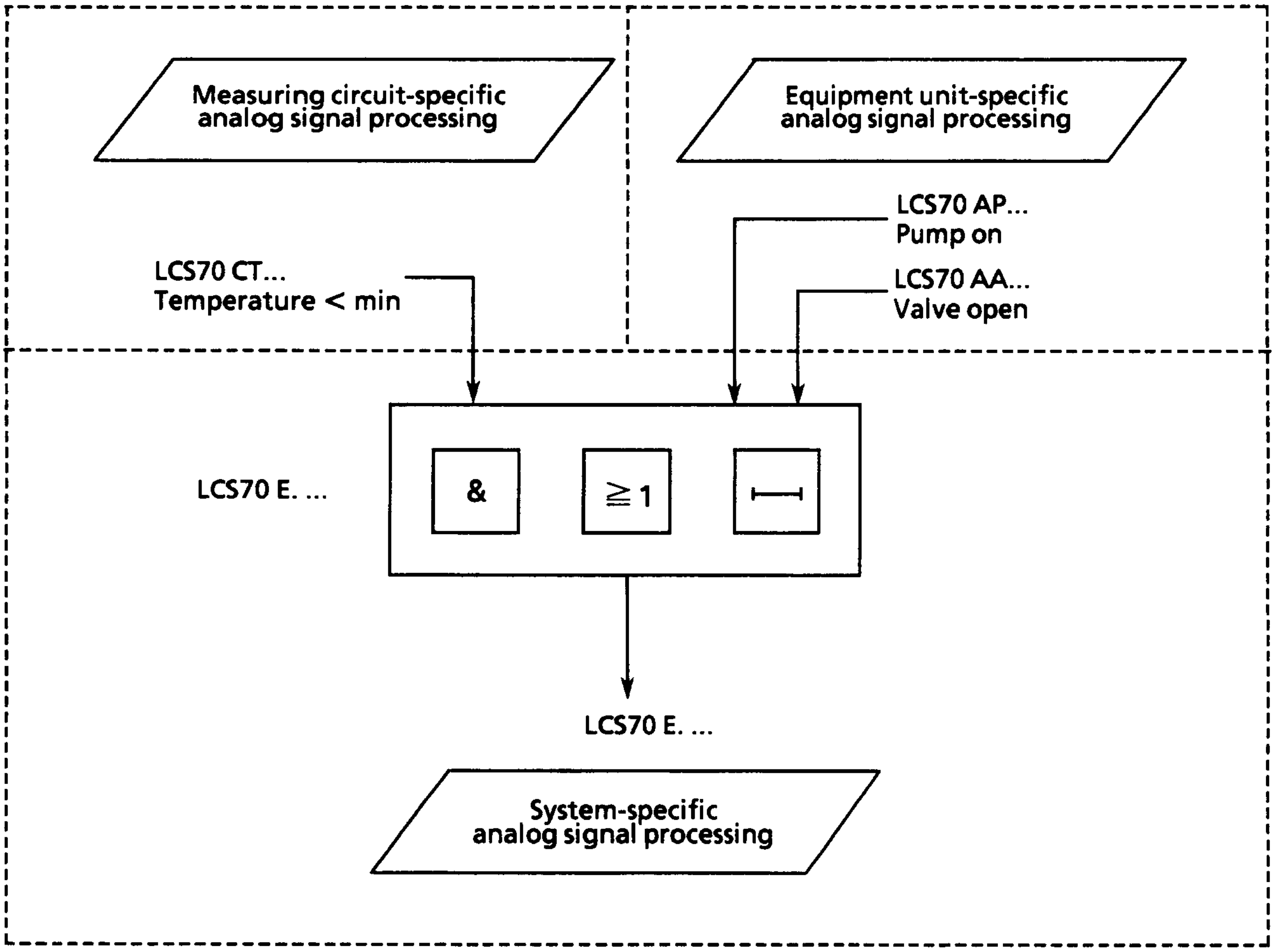
Data character A_2 identifies instrumentation and control functions (e.g. alarm gating, subgroup control).

The process-related code is retained at the function code.

Example 2.1.5/1: Retention of existing process-related code for "analog signal processing" (process-related representation)



Example 2.1.5/2: Analog signal processing for reheater condensate system (I&C representation)



This type of analog signal processing is neither measurement circuit nor equipment unit-specific and is therefore not identified on the equipment unit level as associated with a measuring circuit or with a equipment unit. System-specific analog signal processing is identified by means of A_1 = *E*, with the type of signal processing (e.g. functional group control, subgroup control, alarm gating, higher-level protection) specified in A_2. The code for the associated process system is always used as the code on breakdown level 1.

Corresponding examples are given in the sections on open-loop and closed-loop control, protection and monitoring.

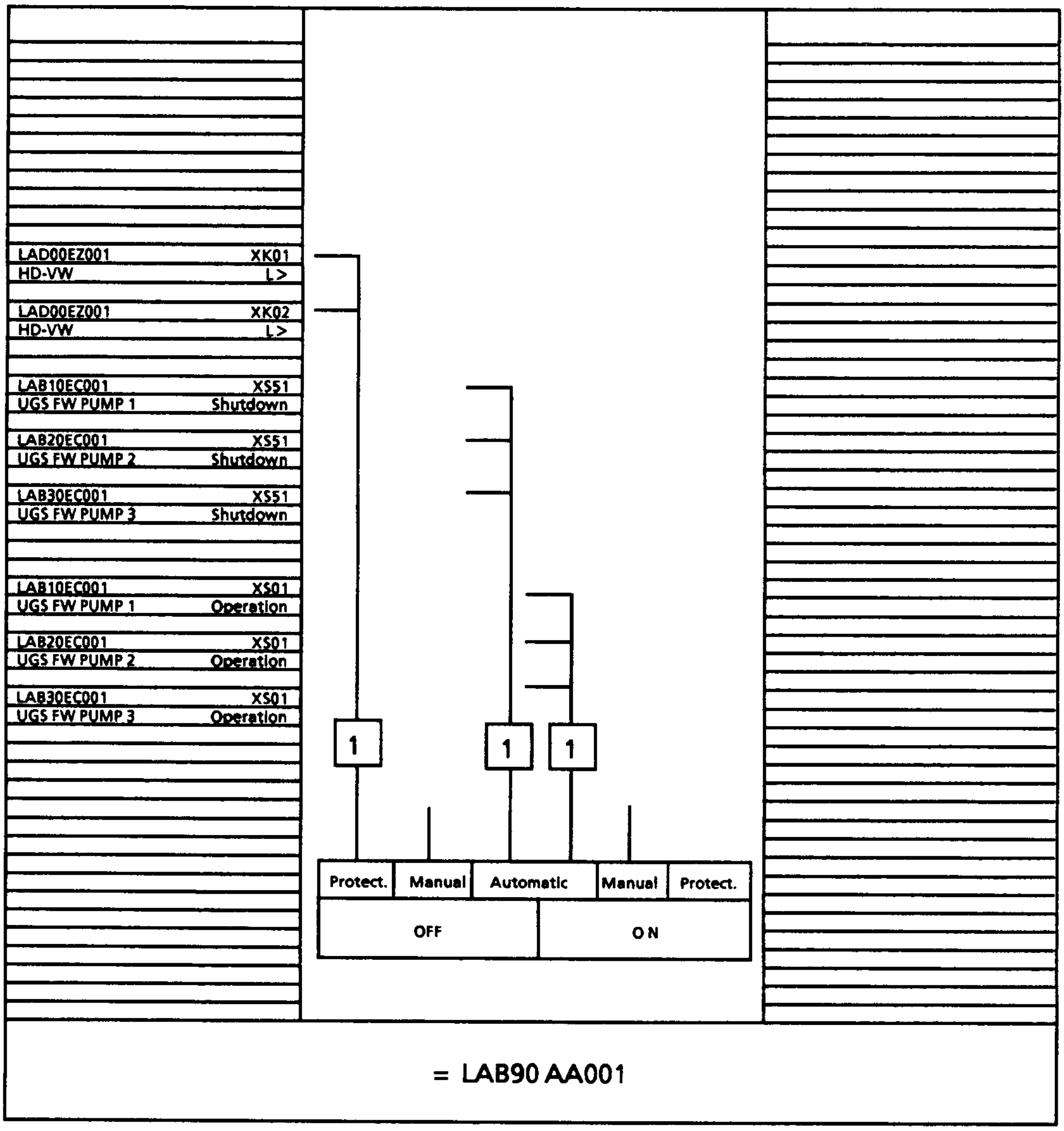
2.2 Open-Loop Control

The same basic principles hold for identification of open-loop controls as for identification of analog signal processing, with the process-related engineering identification on breakdown level 1 retained independent of the task. Identification is assigned on the basis of the process system or equipment unit, independent of the automation task to be performed.

2.2.1 Measured Data Processing

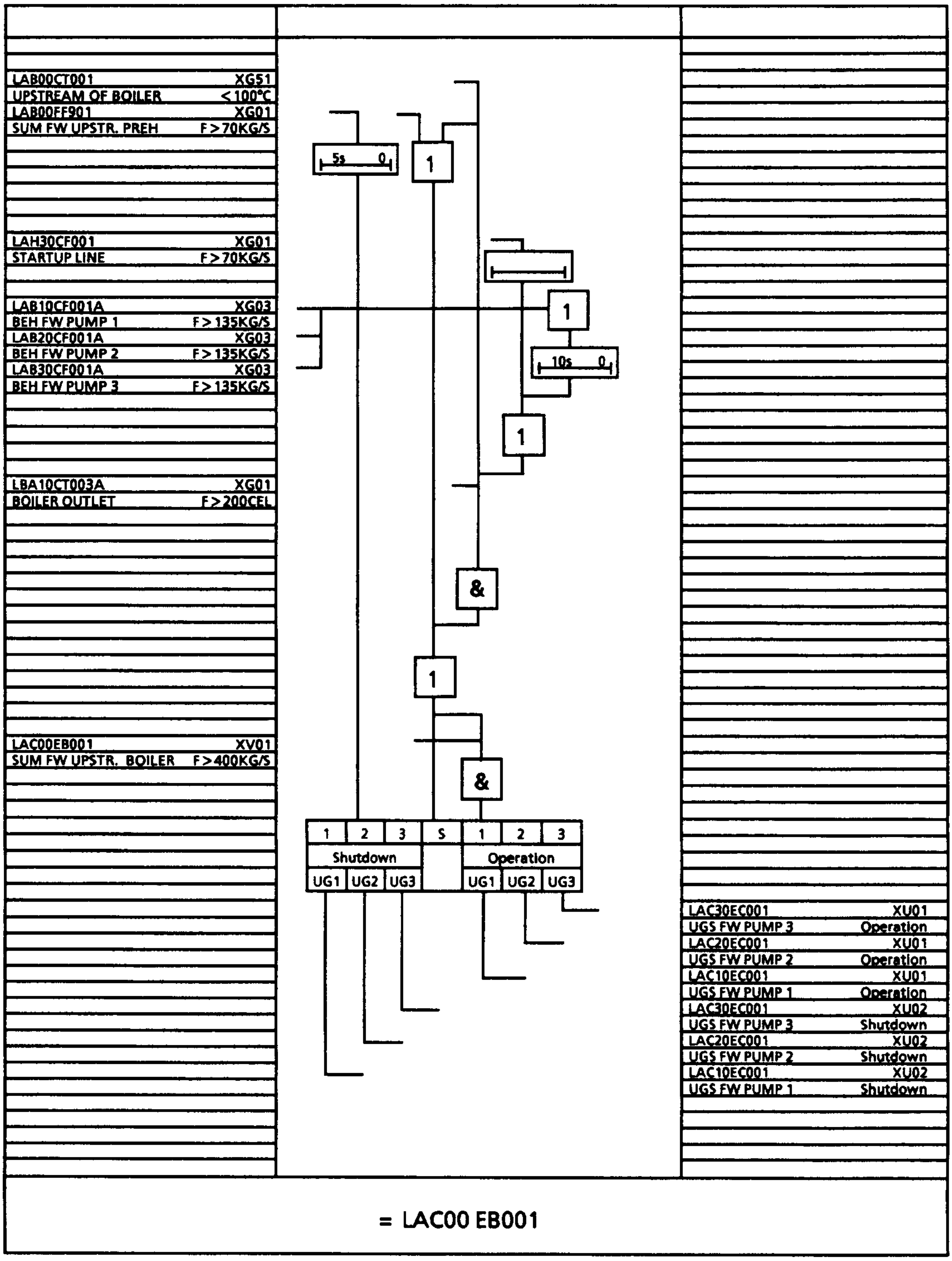
Once the analog signals have been distributed, they are used within the open-loop control, with existing codes retained here.

Example 2.2.1/1: Feedwater isolation valve, signal processing for control interface LAB90AA001

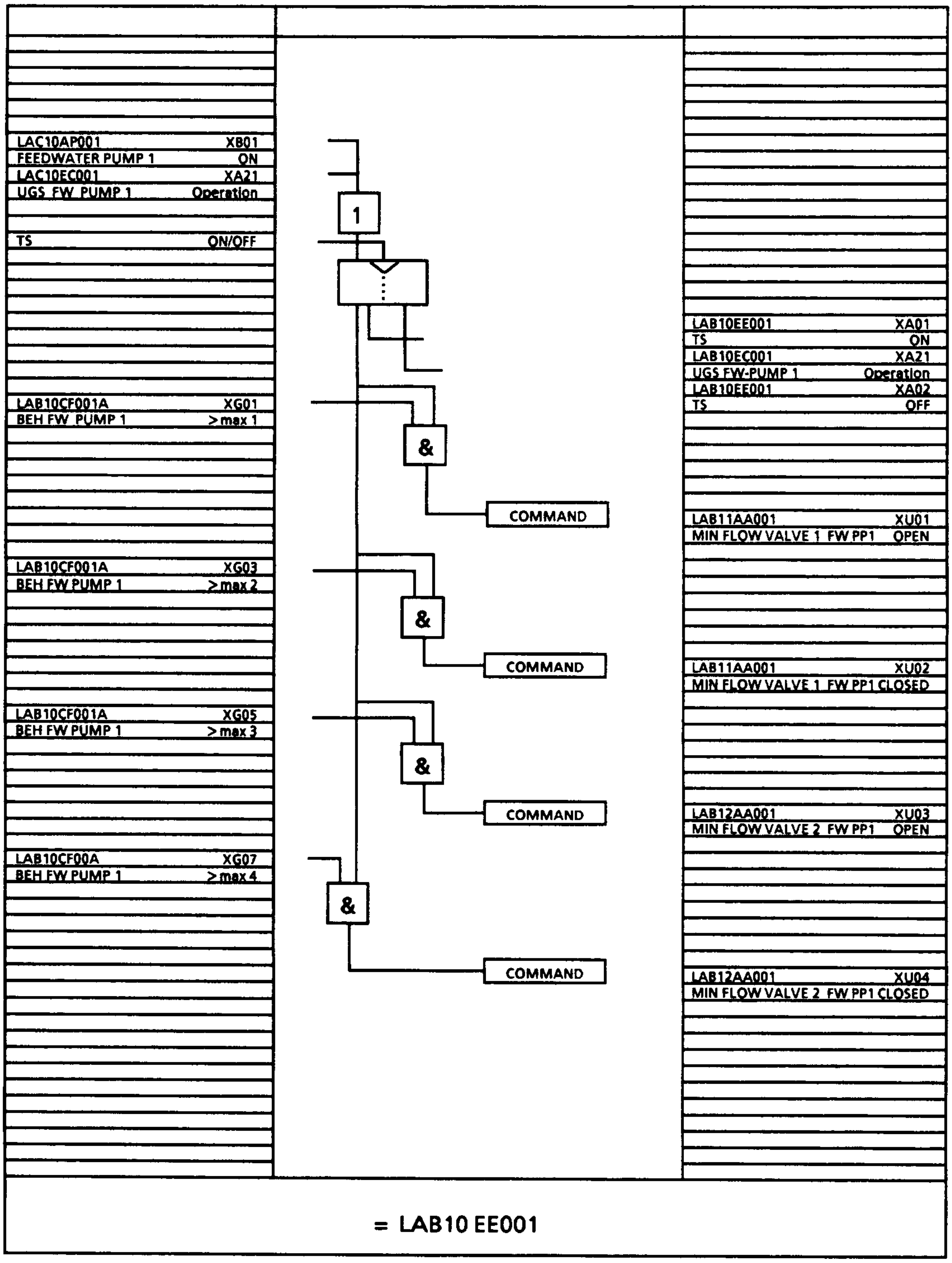


In addition, there are automatic controls within the signal processing which are implemented on the basis of system-specific signals and are identified after gating by *E.* (to denote "analog and binary signal conditioning"):

Example 2.2.1/2: Functional group control for feedwater pump system (pump selection)



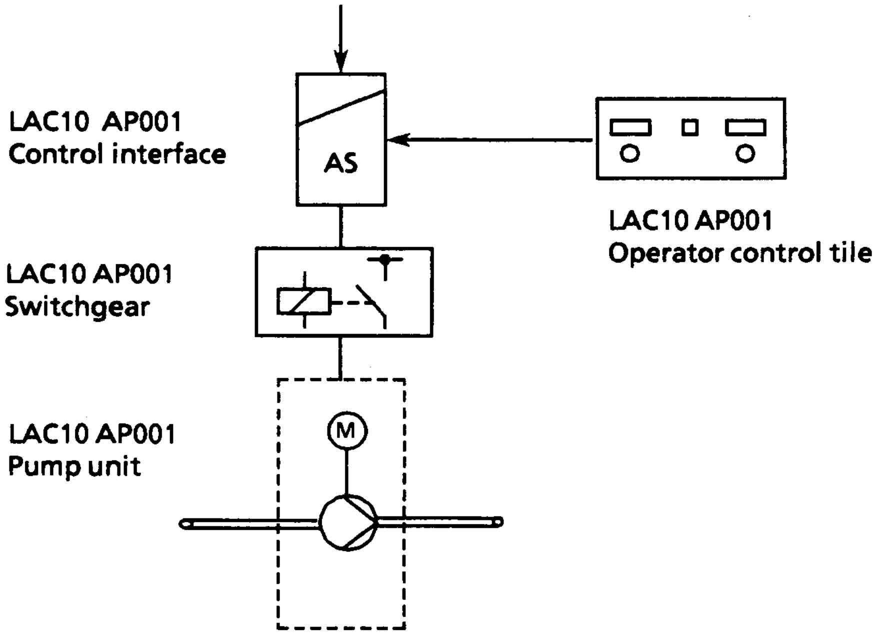
Example 2.2.1/3: Subloop control for minimum flow from train 10 of feedwater piping system *LAB*



2.2.2 Control Interface

A module which is clearly associated with an actuator, including the corresponding operator control modules, is assigned the same ID code as the actuator itself.

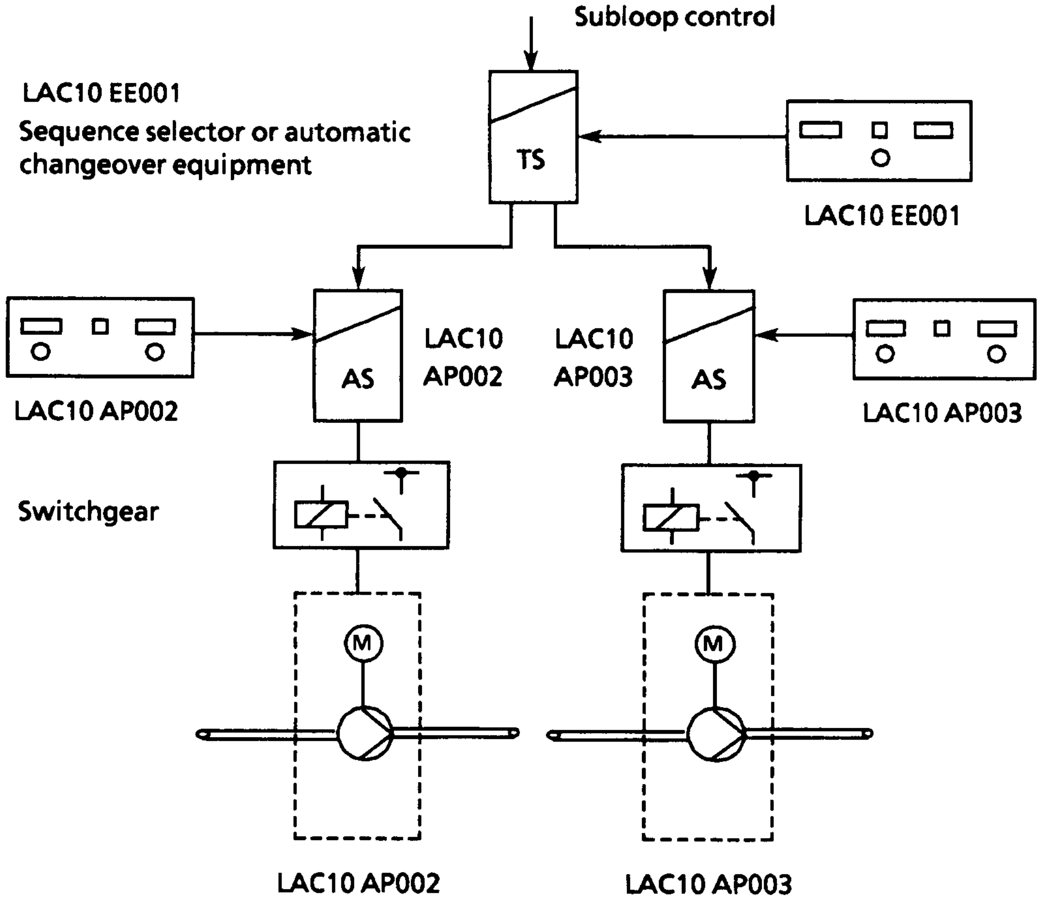
Example 2.2.2/1: Control interface for pump unit LAC10 AP001



2.2.3 Subloop Control (Sequence Selection or Automatic Changeover Equipment)

If several actuators associated with a process system are allocated to a single subloop control, the identification can be as follows:

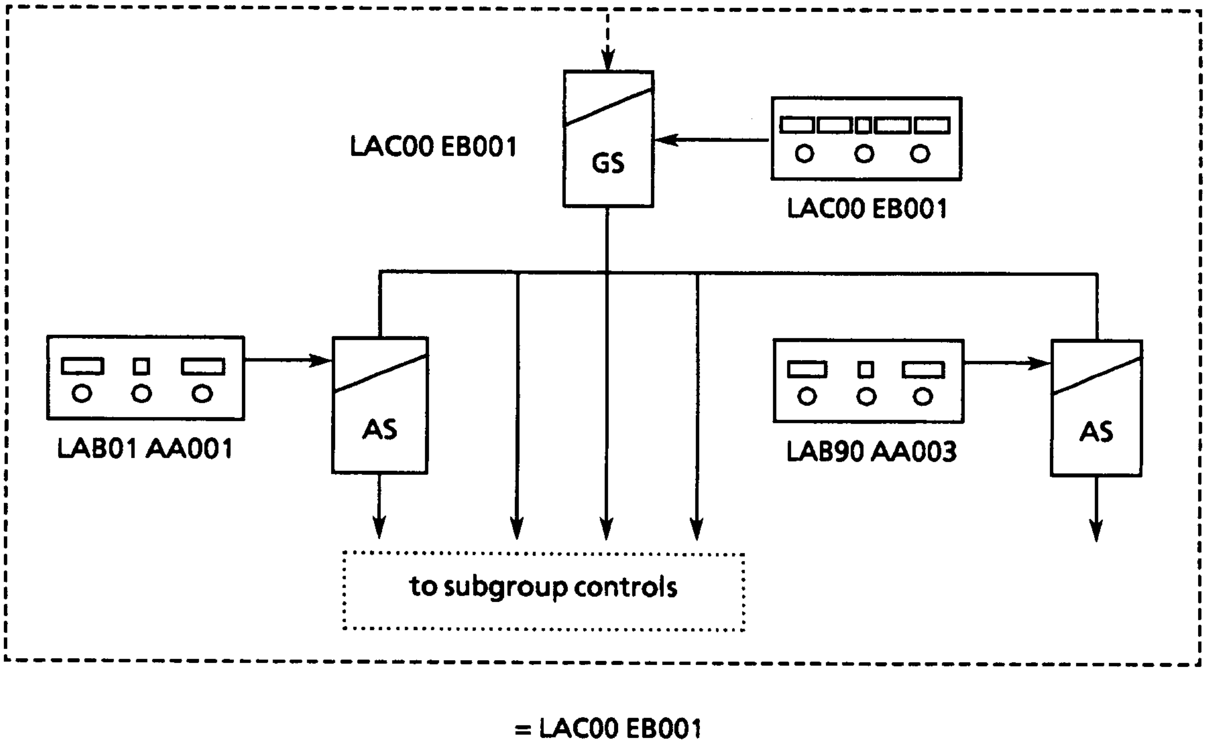
Example 2.2.3/1: Subloop control for 2 drives (auxiliary oil pumps)



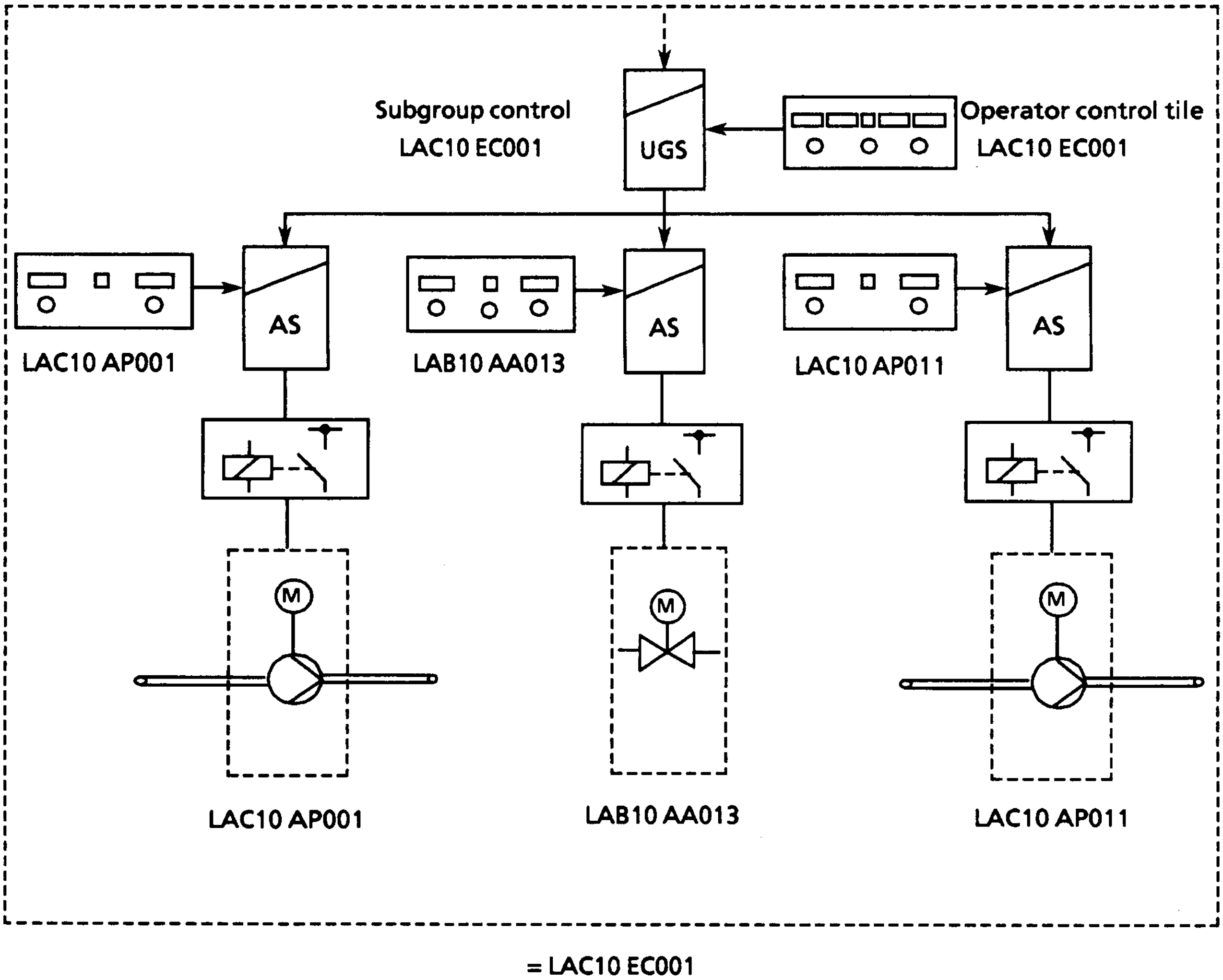
2.2.4 Functional Group Control / Subgroup Control

All drives associated with a process system are allocated to a functional group control or subgroup control, which is identified in the same way as the associated system in breakdown level 1. While the definition of a subgroup control encompasses all auxiliary drives associated with a main equipment unit, several main equipment units of the same degree of importance are controlled by a functional group control.

Example 2.2.4/1: Functional group control for system LAC00 with the associated control interfaces



Example 2.2.4/2: Functional group control for system LAC10



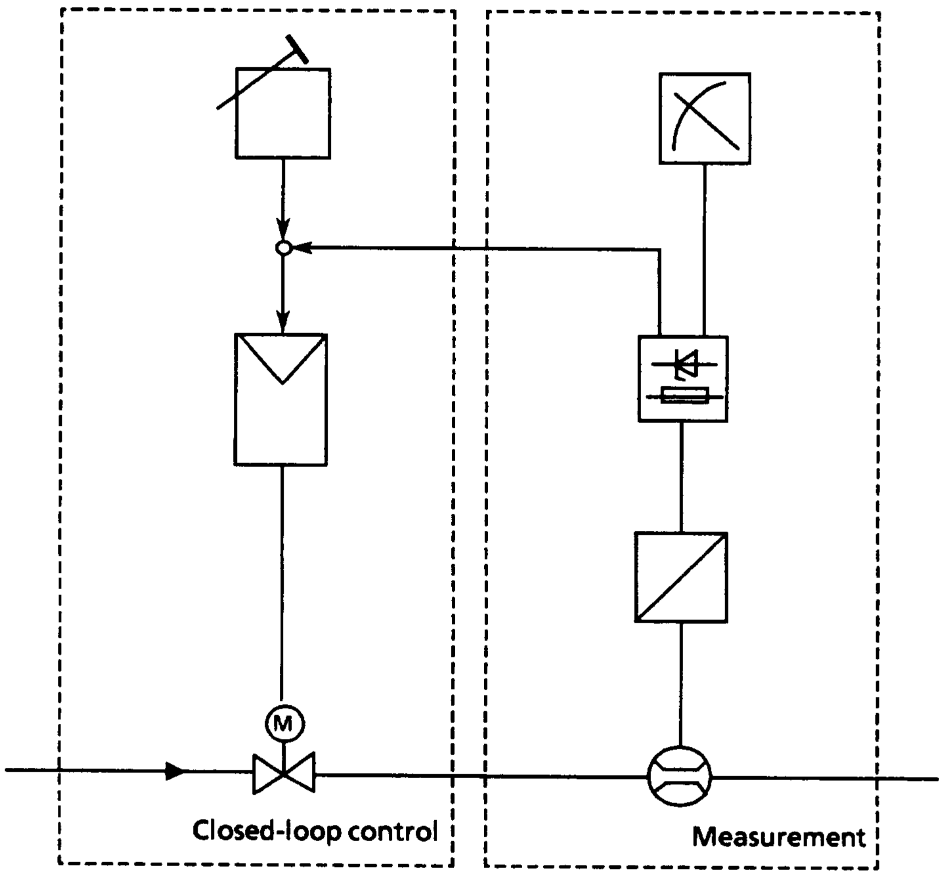
2.3 Closed-Loop Control

The principles for the identification of measuring circuits apply analogously to the identification of closed-loop control circuits on breakdown level 1. Every control loop and every closed-loop control circuit comprises measuring, control and positioning elements regardless of whether electrical, pneumatic hydraulic or other items of equipment are used. Closed-loop controls are identified according to the controlled variable and not after the measuring circuits which serve the control or the final control element on which the control acts.

2.3.1 Measured Data Processing

Measured data processing in closed-loop controls is the same as in open-loop controls; therefore Section 2.2.1 holds.

Example 2.3.1/1: Delineation between measurement and closed-loop control

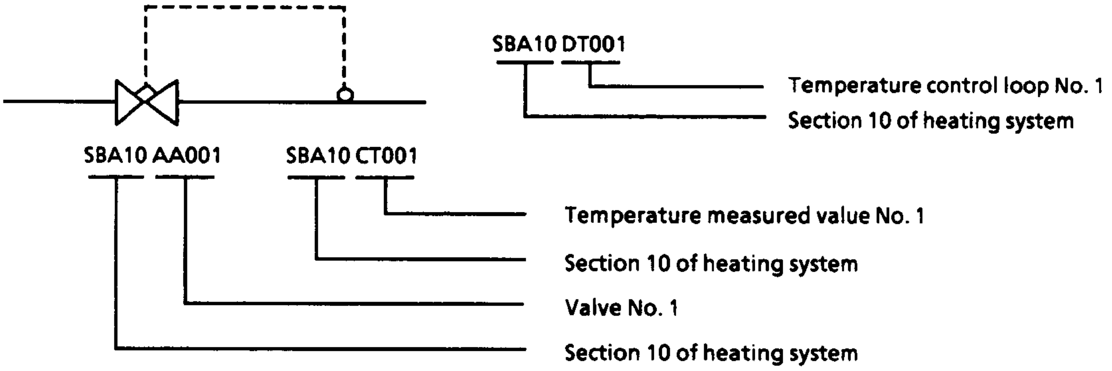


The closed-loop control is only a goal of measurement.

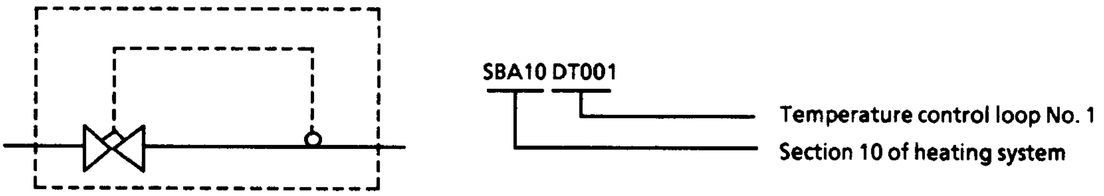
2.3.2 Simple Control Loops

Direct-action mechanical controls

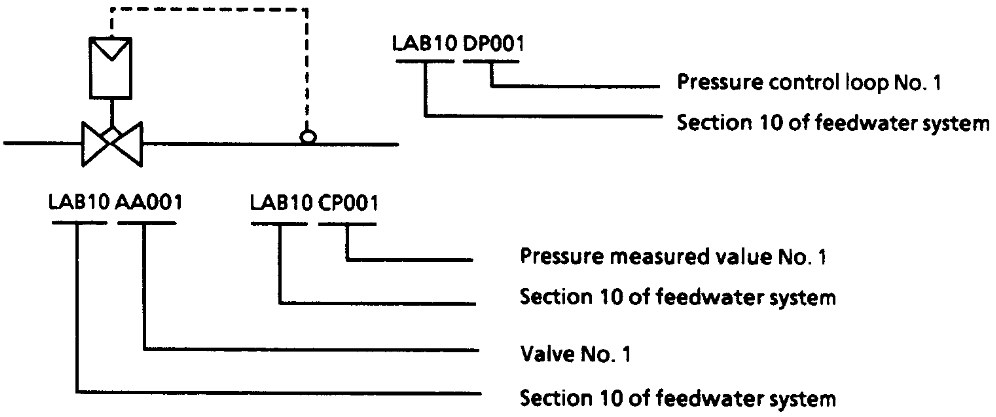
Example 2.3.2/1: Direct-action mechanical control with separate measuring point



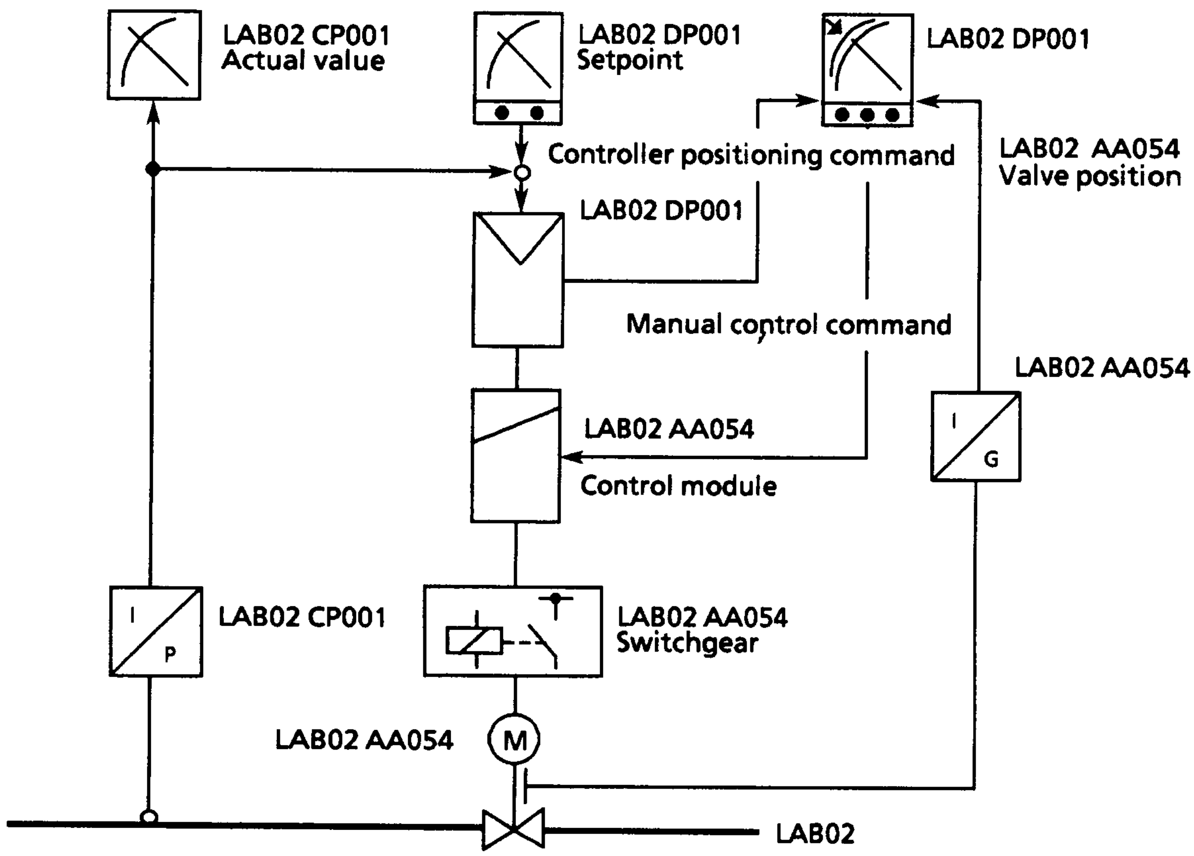
Example 2.3.2/2: Direct-action mechanical control, compact design
Simple mechanical / pneumatic / hydraulic / electrical control.



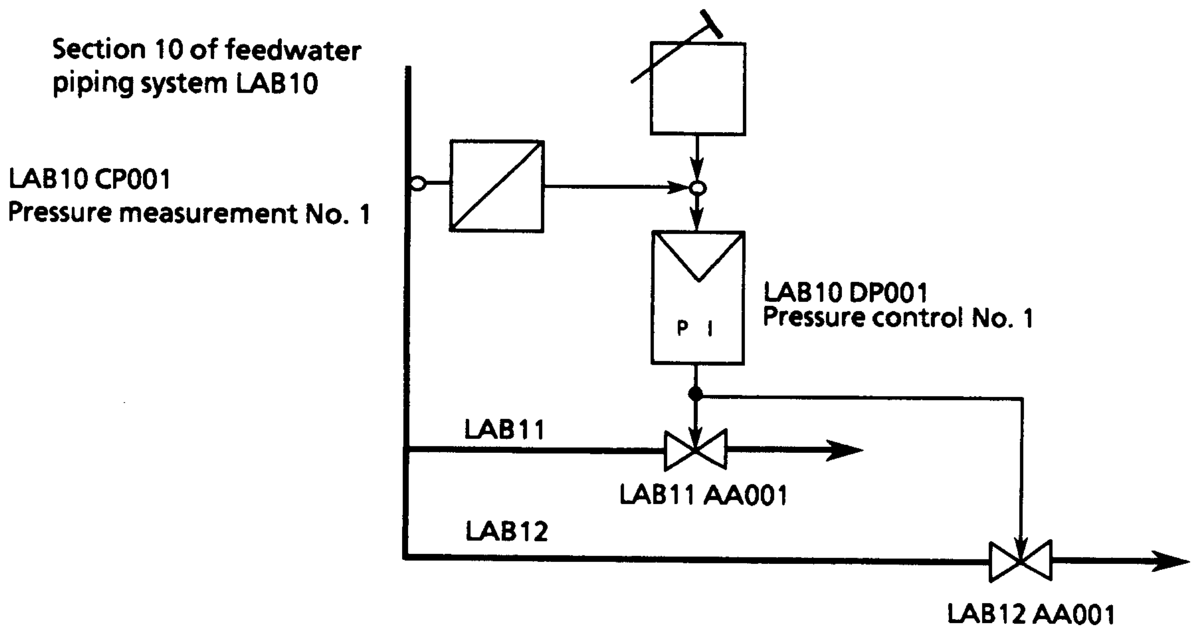
Example 2.3.2/3: Pressure control in feedwater system



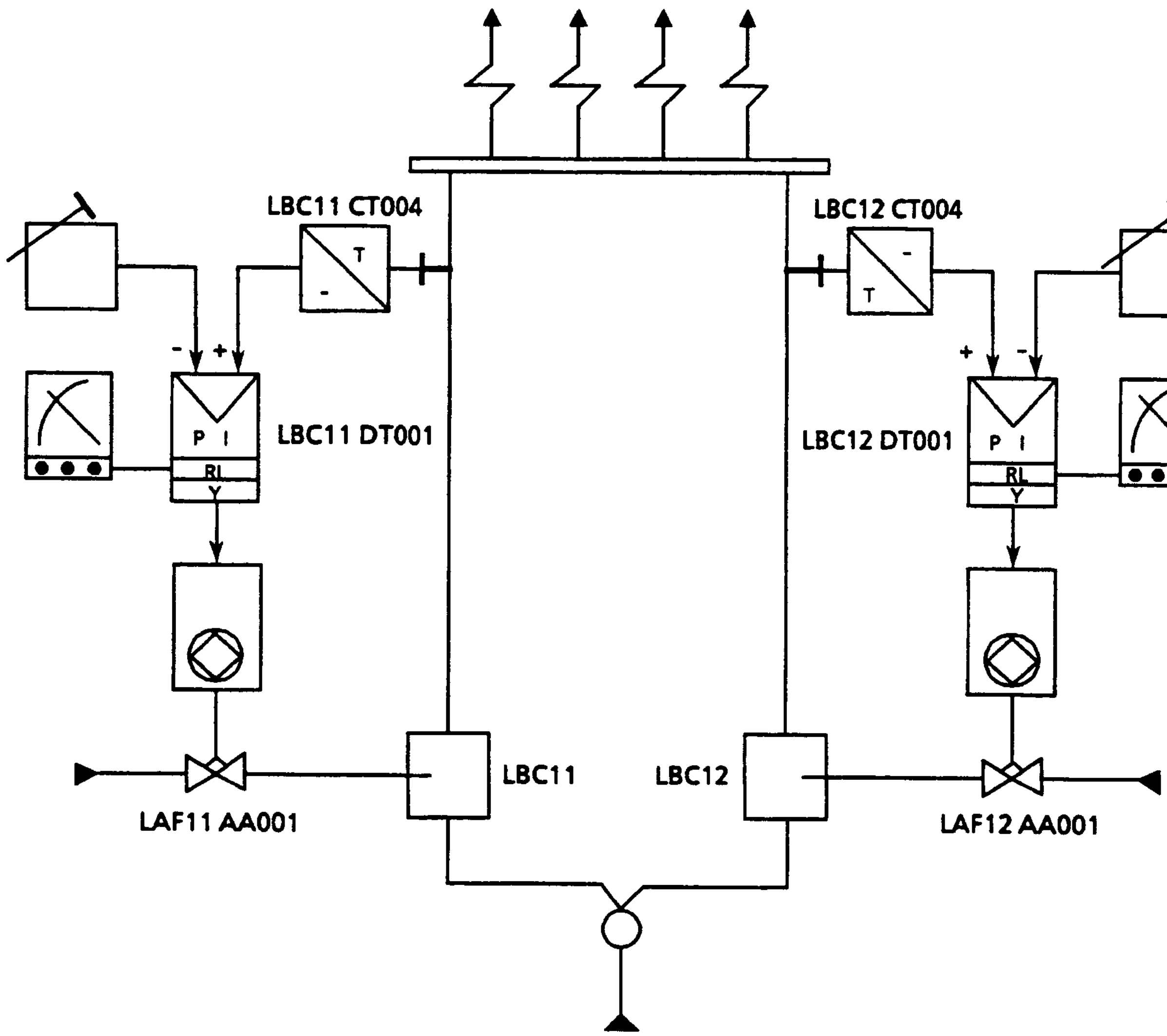
Example 2.3.2/4: Identification of individual devices associated with a simple control loop



Example 2.3.2/5: Closed-loop control and final control elements in different systems

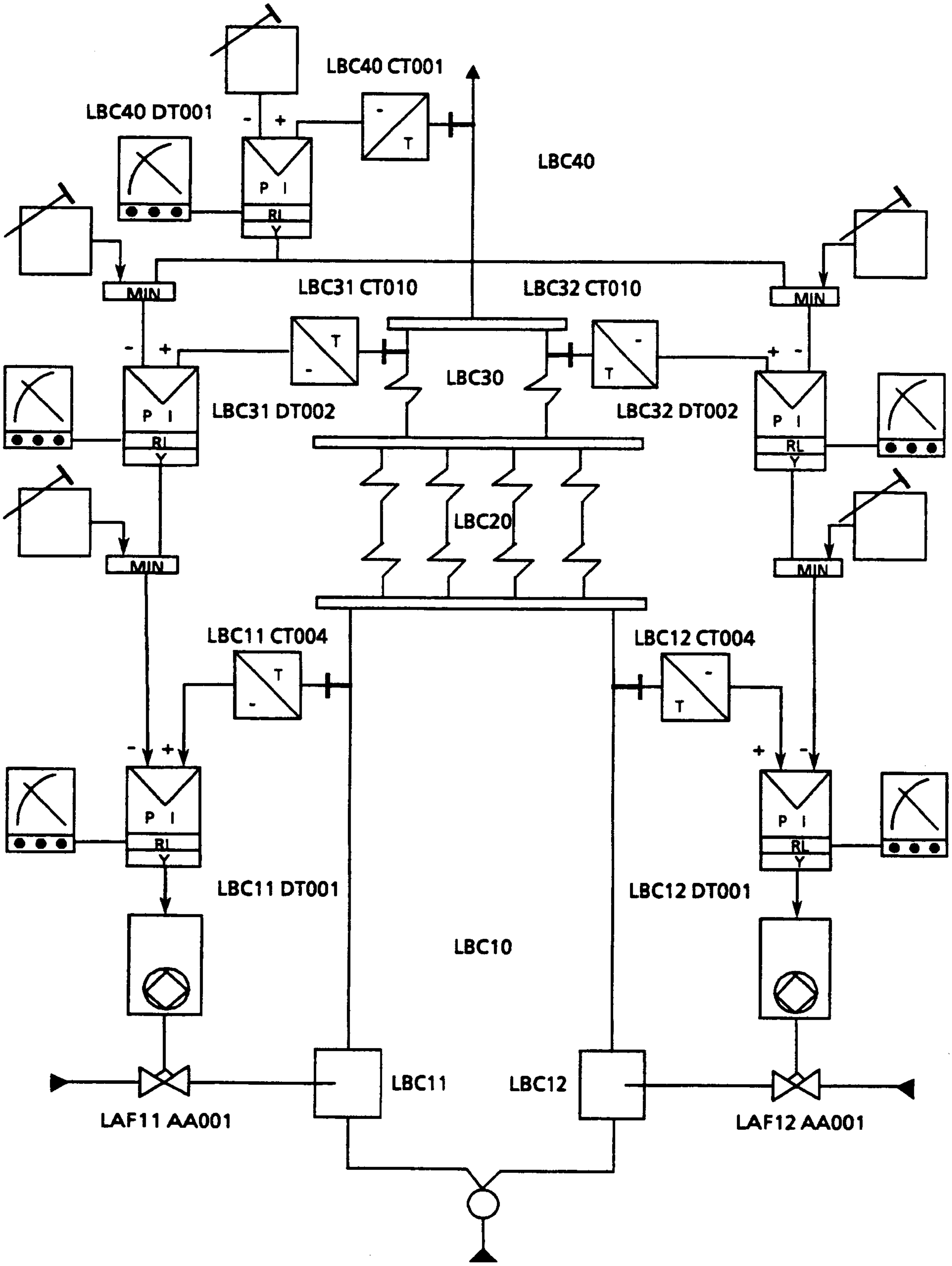


Example 2.3.2/6: Temperature control for reheat system



2.3.3 Setpoint control

Example 2.3.3/1: Higher-level control loops for reheat system



2.4 Protection

Identification of I&C protection systems differentiates between the protective logic system, which protects an equipment unit against inadmissible operating conditions, and the protection system, which rules out danger to the plant or to personnel. The identification of the process systems is reflected in the I&C systems. A number of examples are given below.

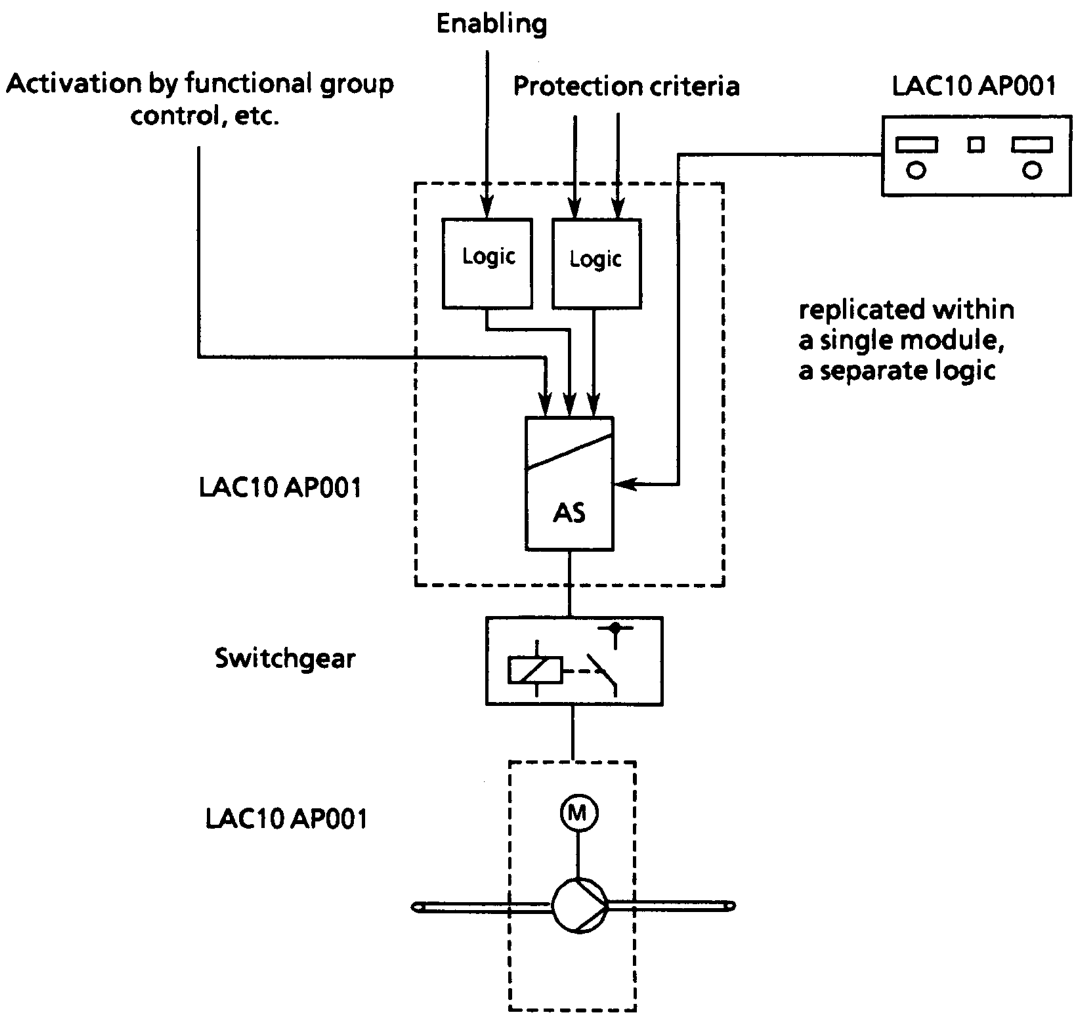
2.4.1 Measured Data Processing

Signal processing in protection equipment is the same as in open-loop controls; therefore Section 2.2.1 holds.

2.4.2 Protective Logic (Equipment Unit Protection)

All of the protective logics associated with a single drive or with a number of drives that are interrelated in process terms are identified in the same way as the system on breakdown level 1 and in the same way as the equipment unit on the equipment unit level.

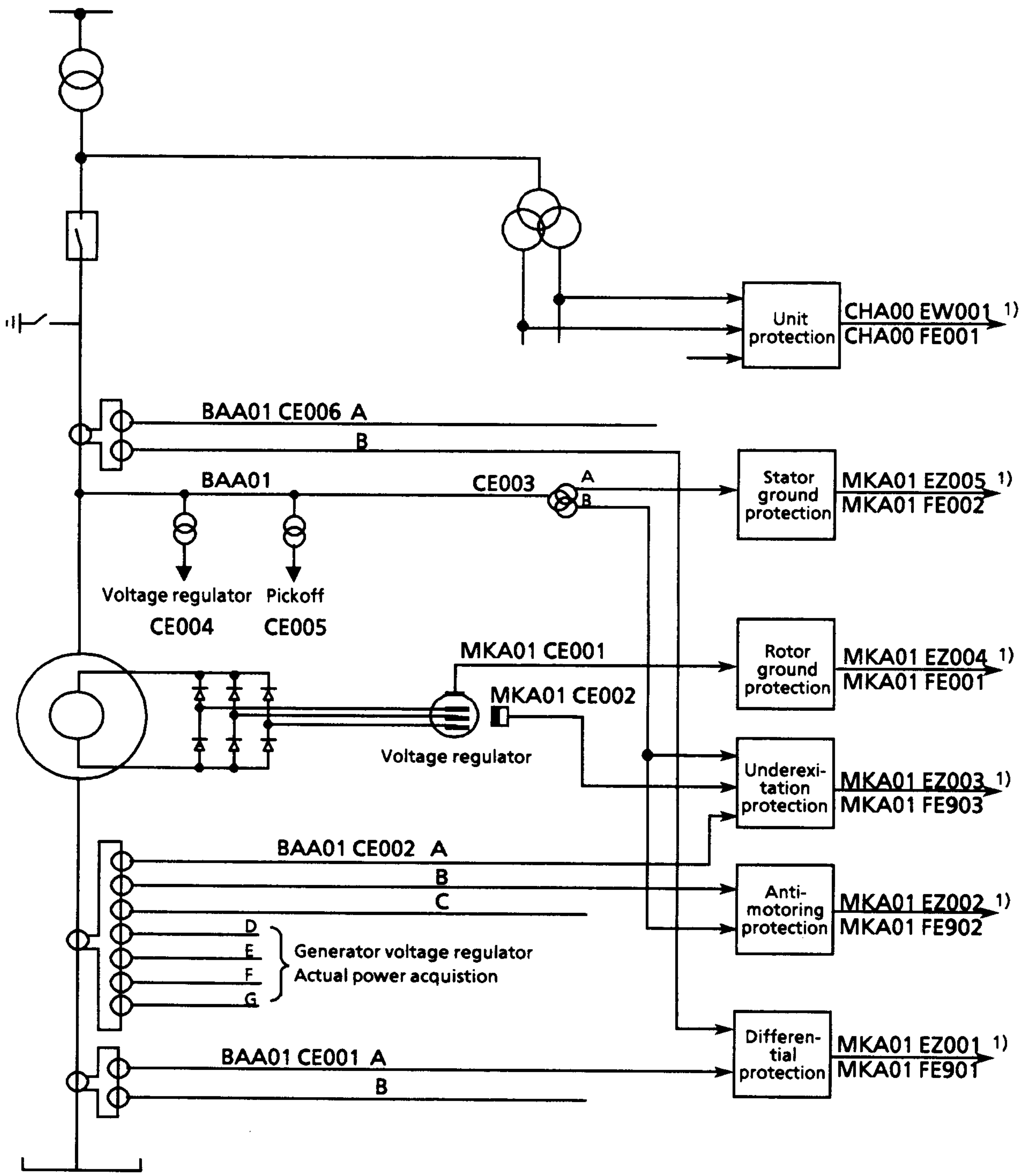
Example 2.4.2/1:



2.4.3 Protection (Plant Protection)

As was already stated in Section 2.4.2, a protection system which clearly belongs to a process system is identified on breakdown level 1 in the same way as the system. See also Example 2.4.2/1.

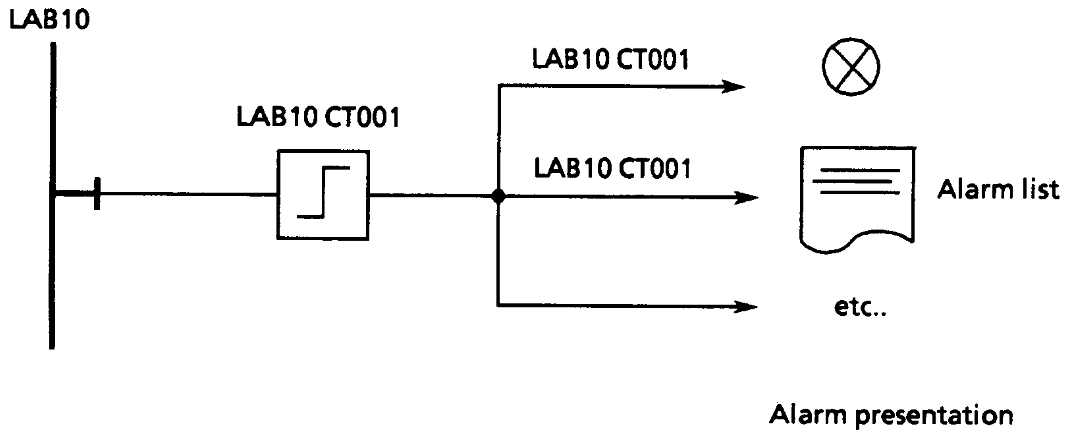
Example 2.4.3/1:



2.5 Monitoring (Alarms, Logs, Information)

Measuring points and signals in I&C systems which perform monitoring functions - including formation of alarms and messages, output of logs, on-screen data display, etc. - are identified with the same KKS code as for the signal acquisition/sensing equipment.

Example 2.5/1:

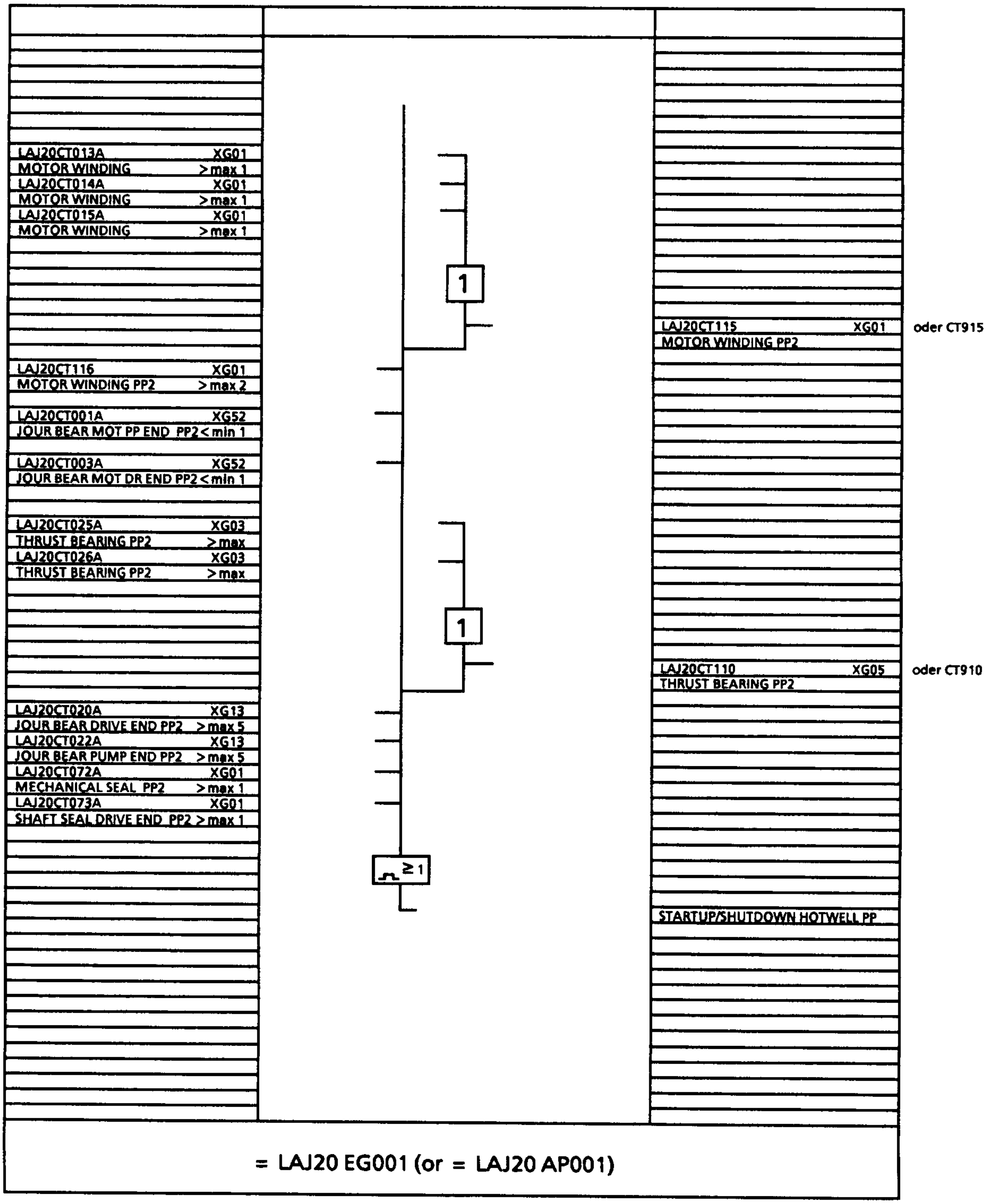


For identification of gated alarms it is important to ensure traceability of the source individual alarms in which the alarm text is useful for the operators.

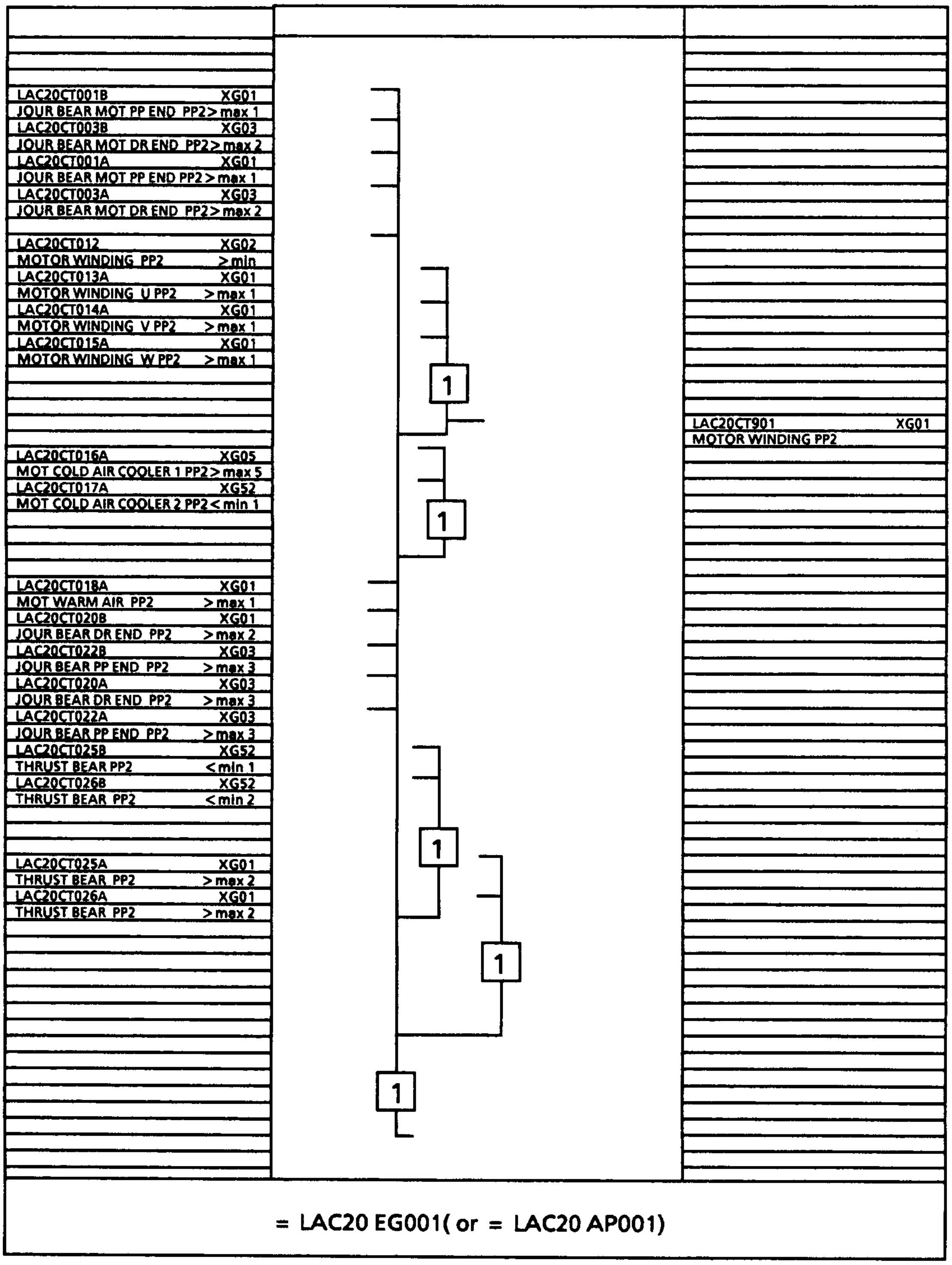
2.5.1 Measured Data Processing

The processing of signals does not result in changed identification. Examples are given for gated alarms.

Example 2.5.1/1:



Example 2.5.1/2:



Signals from function-specific signal processing are grouped within the I&C equipment to form alarm, control and protection criteria for individual equipment units.

This drive-specific logic gating is identified on the basis of the related equipment unit (the cause for these signals).

3 Identification of Instrumentation & Control with Functions Allocated to More than One Process System

Generic Identification Procedure

Where instrumentation and control equipment serves more than one process system (identified in F_2 and F_3), the letter *Y* for generic control and protection systems may be used in the appropriate data character on breakdown level 1. Instrumentation and control equipment which serves more than one main group may be identified under main group *C* for instrumentation and control, e.g. unit control systems = *CJA*.

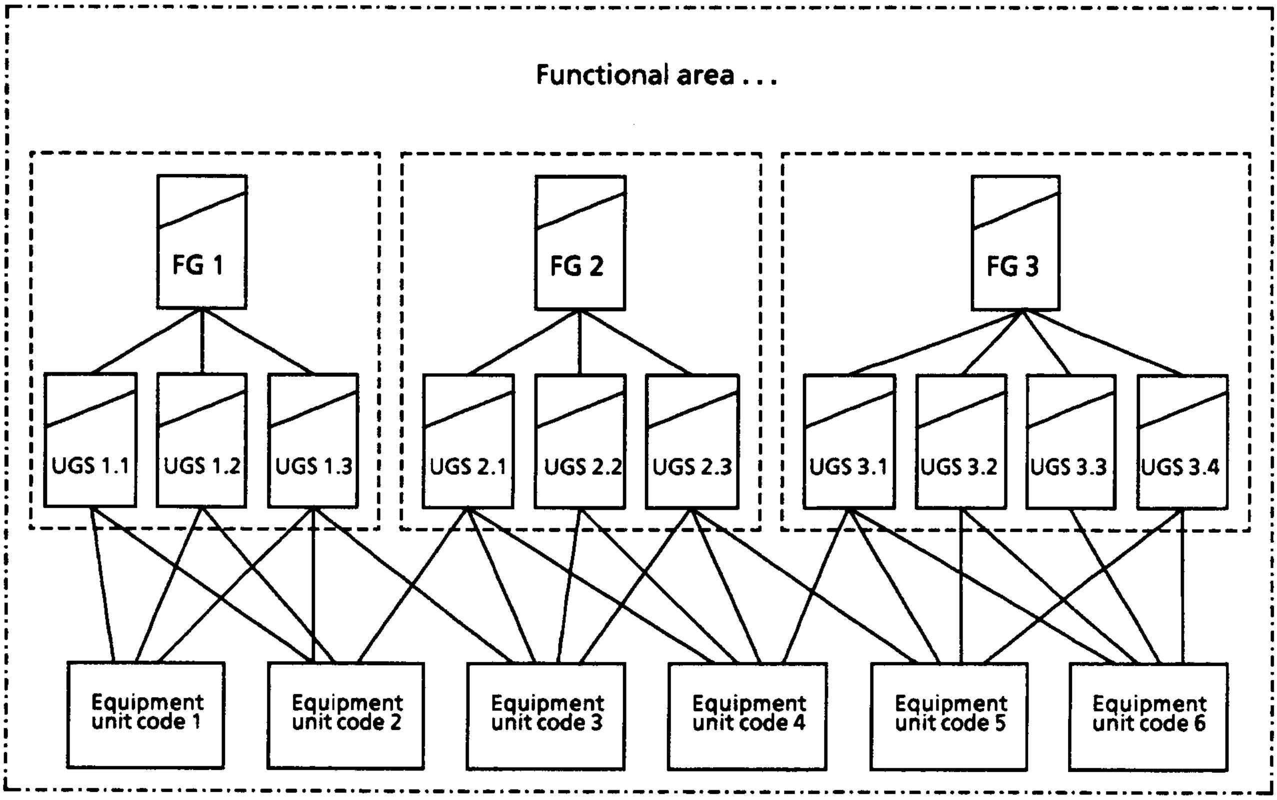
Example 3/1:

Process-related systems		Generic instrumentation and control equipment	
ID-Code	Designation	ID-Code	Designation
LAB LAC LAD	Feed water piping system Feed water pump system HP feedwater heating system	LAY	Control and protection equipment for feedwater system (common to LAB, LAC und LAD)
LA. LB.	Feedwater system Steam system	LY.	Control and protection equipment for steam, water, gas cycles (common to LA . und LB.)
H.. L.. M..	Conventional heat generation Steam, water, gas cycles Main machine sets	CJA	Unit control system (common to H.., L. und M..)

Given the possibilities shown in the table, it is not practicable to meet all possible requirements for identification of discrete process-related functions (e.g. functional group control). Thus for example, it may be necessary to use items which are identified differently on breakdown level 1 (main system and associated parts of auxiliary and ancillary systems) in order to fulfill a given process-related task (functional group). Identification of the functional group involved in process-related tasks so as to relate them to the principal task concerned may be performed by using the alpha characters in F_1 - F_3 of the principal process-related task.

In this application, however, a suitable identifier such as a prefixed *Y* should be used to indicate that a software coding unit is concerned, so as to rule out confusion with process-related codes. This code is subject to agreement between the parties to the project.

Example 3/2: Conceptual layout of units for functional representation and associated KKS system codes



As various KKS system codes are grouped together in the functional groups and subgroups shown, it is only possible to employ the most important KKS system code and to distinguish this from the KKS component codes by a clear differentiating element.

Example 3/3: Switchgear building ventilation comprising KKS systems as follows

SAC HVAC system

and

QKS Chilled water system

and

SBC Space heating system

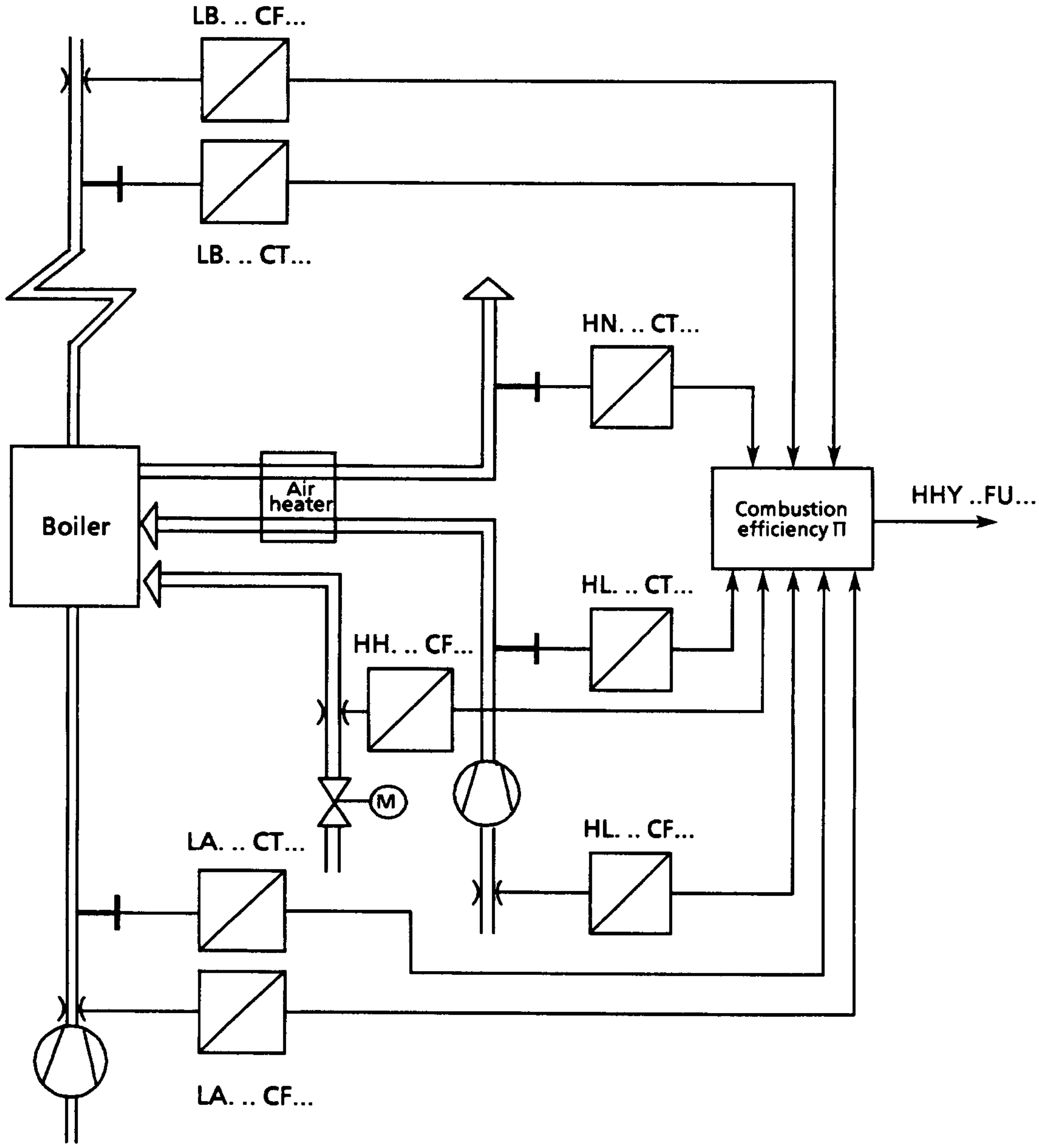
The overall function is identified by *SAC*

3.1 Measurement (Signal Acquisition, Distribution, Processing)

3.1.1 Measuring Circuits Serving More Than One Process System

Where measuring circuits form signals by linking signals from more than one process system, the new signal cannot be identified on breakdown level 1 in the same way as for a signal from a single acquisition function. A code is entered on breakdown level 1 which indicates a relationship to the process-related identification unit (main firing system).

Example 3.1.1/1: Gated measuring circuit

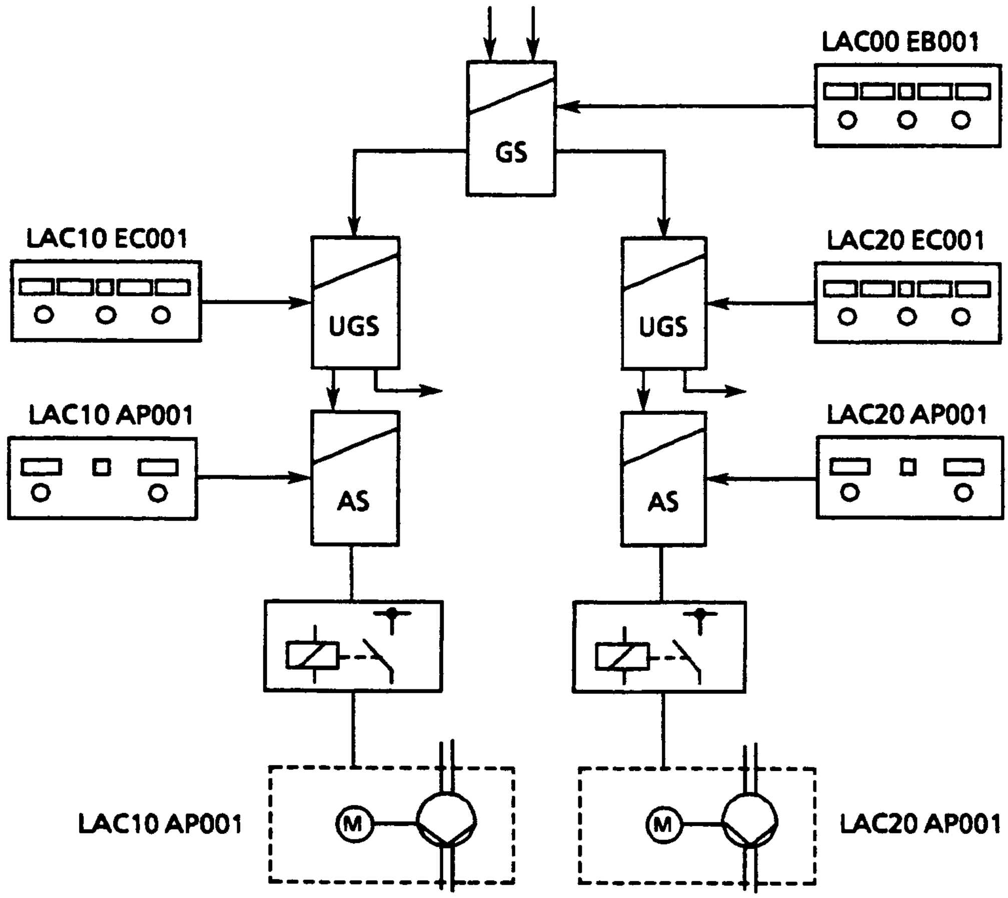


3.2 Open-Loop Control

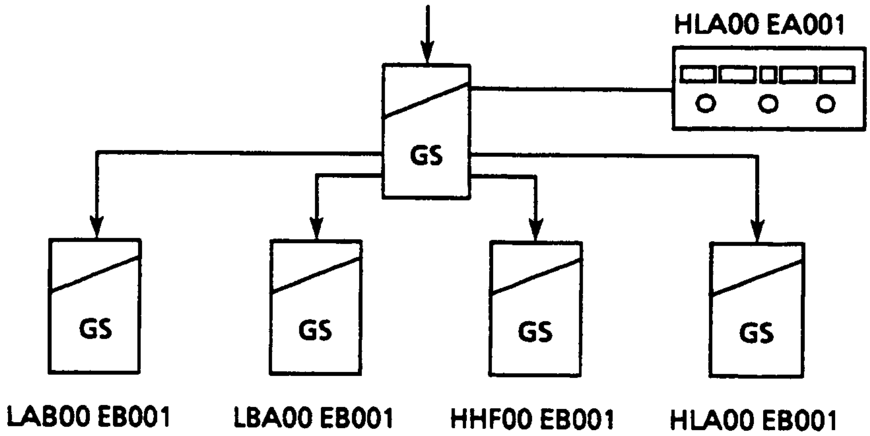
3.2.1 Functional Groups

Where a single functional group control serves for higher-level automation tasks for more than one process system, this functional group control can only receive a single generic code which indicates a relationship to the subordinate systems but is not related to a process system.

Example 3.2.1/1: Feedwater control



Example 3.2.1/2: Boiler air supply

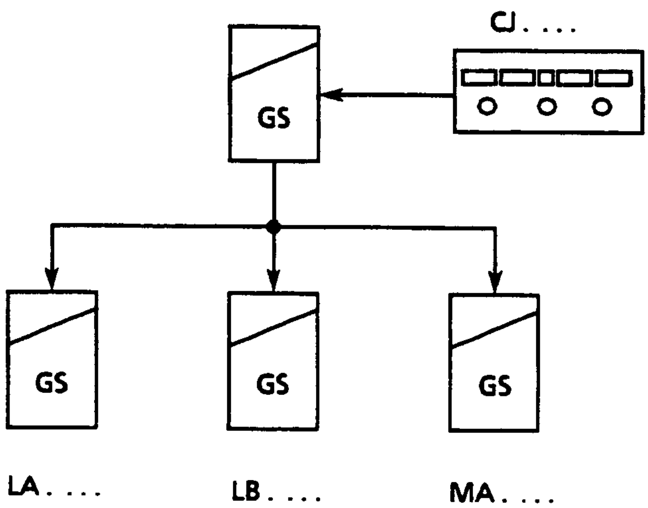


Boiler air supply: with control action on LAB.. (fill), LBA.. (vent) and HHF..(fuel supply). Name is chosen on the basis of the dominant system (HLA..).

3.2.2 Unit Coordinator Level

Where functional groups serve to control a large number of process systems for unit coordination tasks, no system-related code can be assigned on breakdown level 1. In such cases, a generic code is assigned on breakdown level 1.

Example 3.2.2/1: Unit coordinator level



3.3 Closed-Loop Control

3.3.1 Master Controllers

Control circuits which control more than one process system, possibly through slave controllers, must be identified as higher-level controllers on breakdown level 1 (see Section 3).

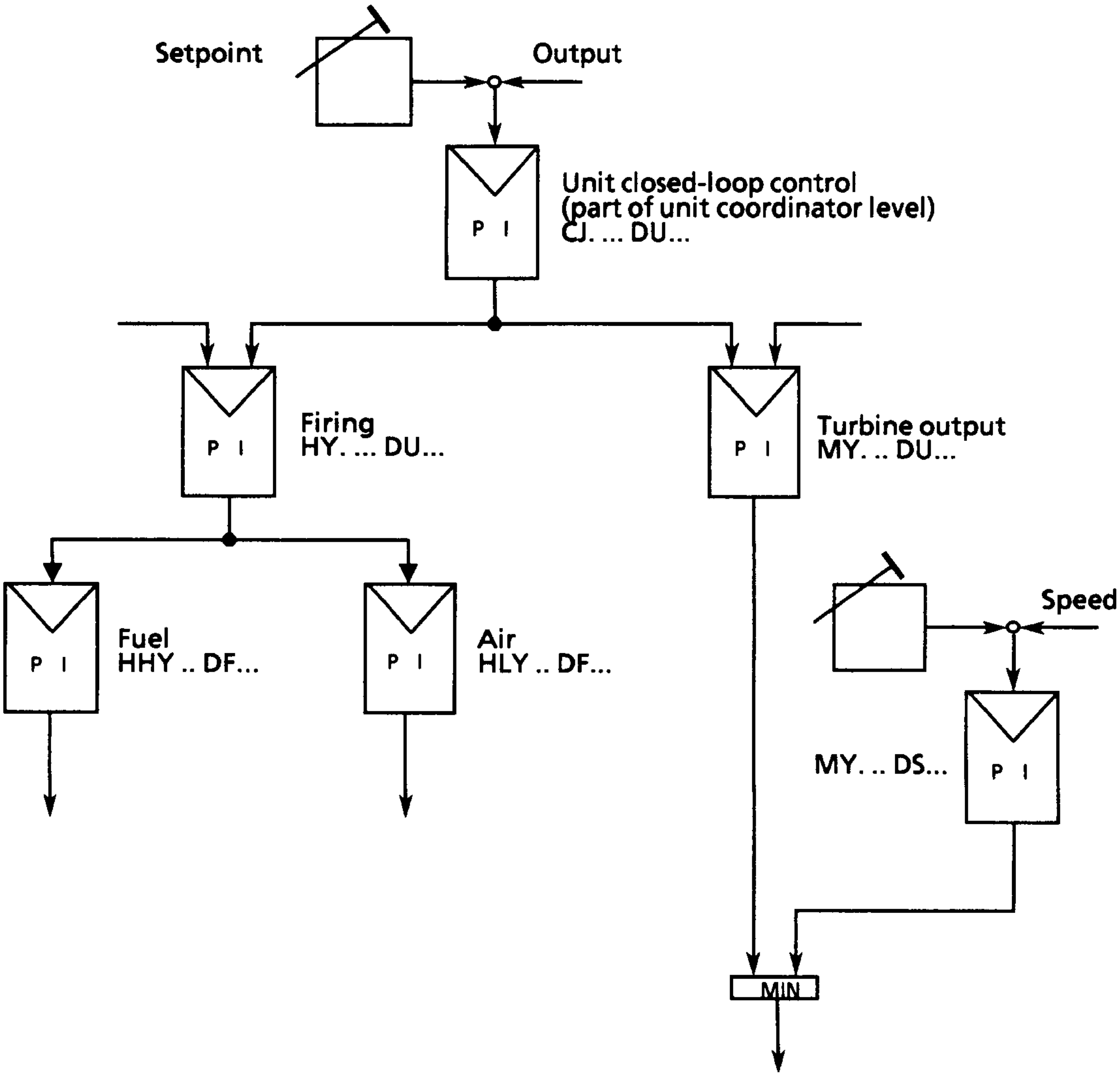
Controls which serve more than one system - with different F_3 data characters - have the same data character at F_2.

Example: See higher-level reheat system control loop in Section 2.3.3.

3.3.2 Unit Coordinator Level

Higher-level setpoint controls or master control loops which are not directly related to a single main process system (e.g. firing system) are assigned generic identifiers on breakdown level 1.

Example 3.3.2/1: Unit closed-loop control

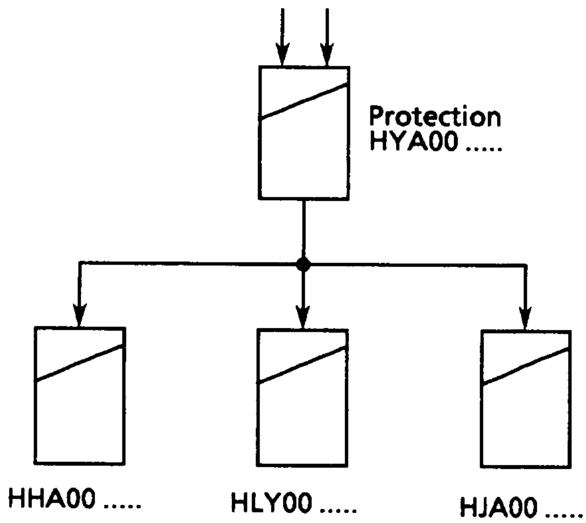


3.4 Protection

Special I&C systems which serve several process systems are implemented to protect main machines, plant components and the overall plant from dangerous conditions or to protect humans and the environment. Identification on breakdown level 1 is a higher-level identification and only indicates the relationship to the system.

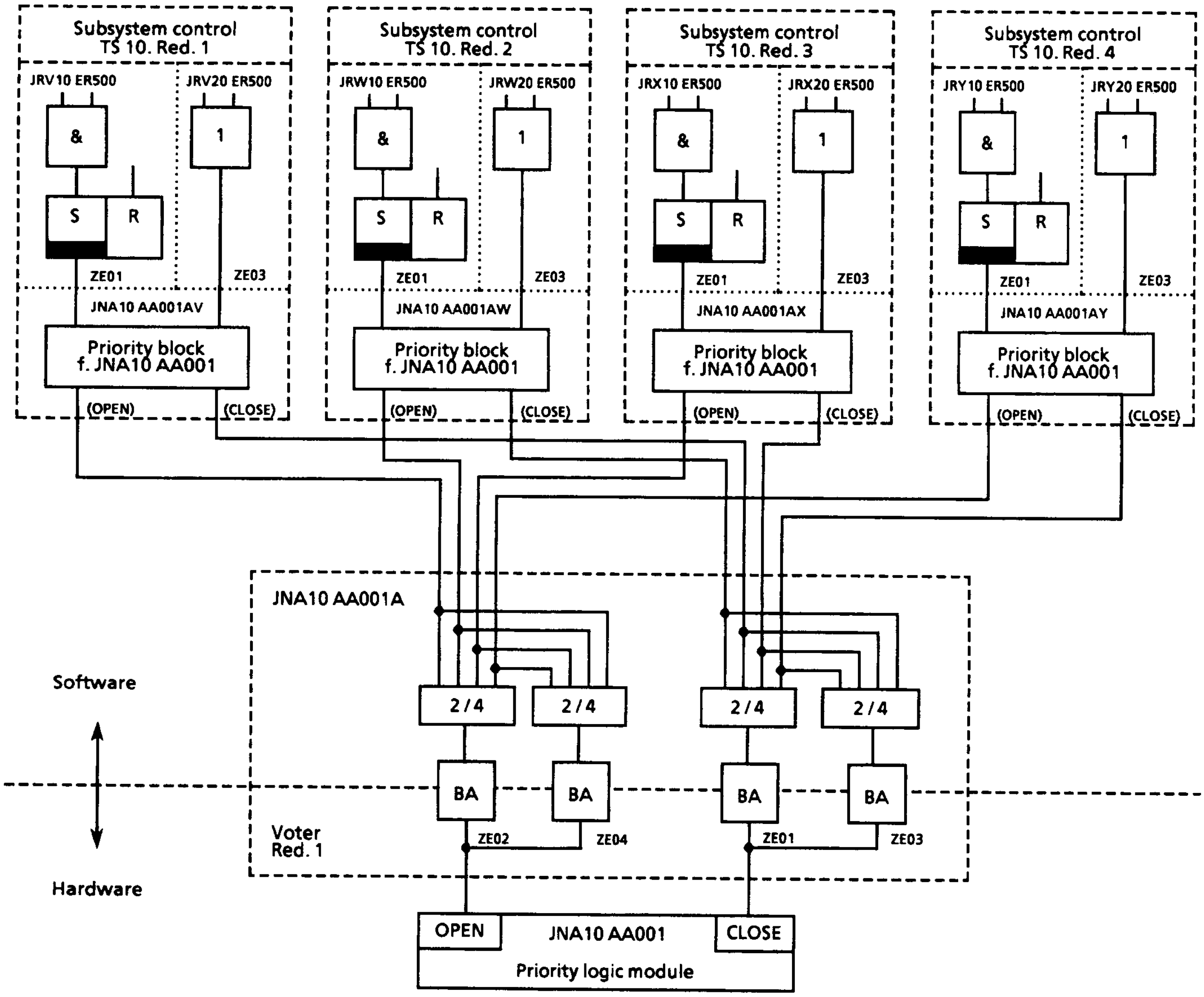
3.4.1 Boiler Protection

Example 3.4.1/1: Boiler protection



3.4.2 Reactor Protection

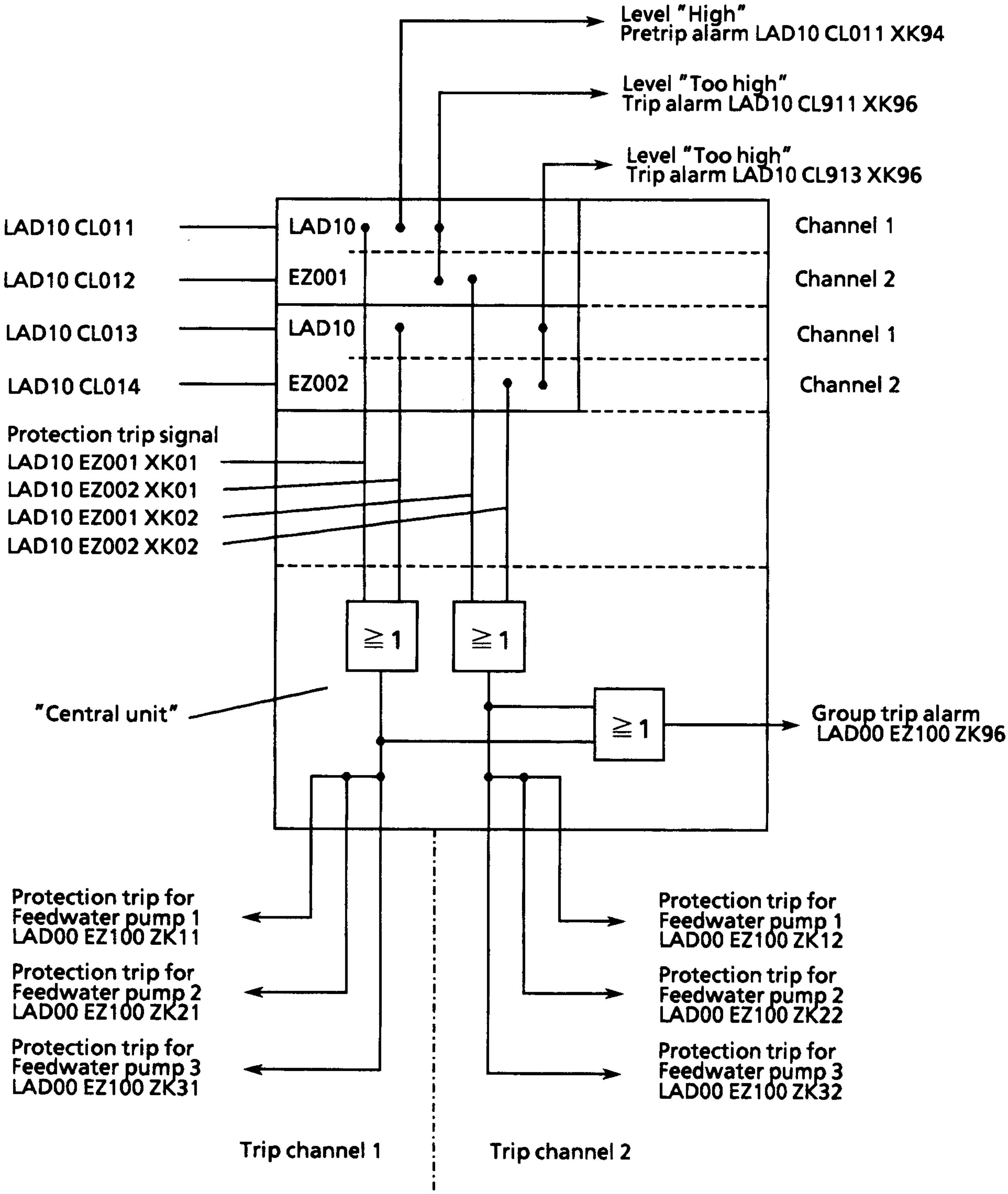
Example 3.4.2/1: Actuation of safety system components



This example shows the necessity to add an additional data character to data character A_3 in certain project-specific applications.

3.4.3 Component and Equipment Unit Protection

Example 3.4.3/1: 2 channel feedwater pump protection

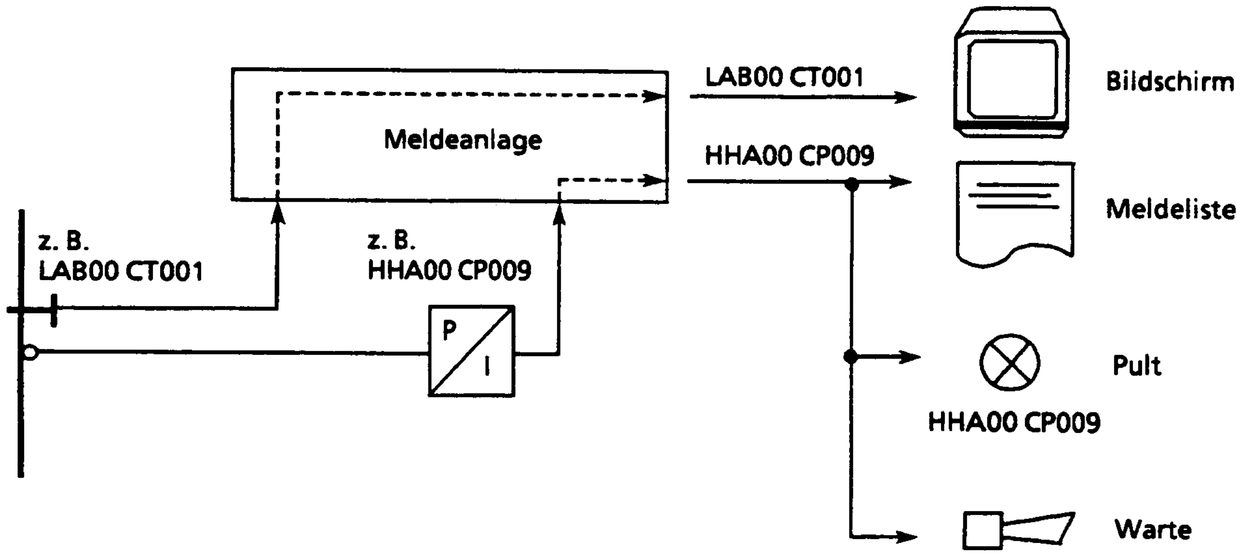


3.5 Monitoring

3.5.1 Alarm Annunciation Systems

Special I&C systems which obtain their information from the process systems or from the associated I & C are used for information presentation. In some cases the information is preprocessed; in others conditions are only interrogated directly. The ID code for the signals remains unchanged to ensure a direct correlation with the process image; no special process code is assigned.

Example 3.5.1/1: Alarms



The identification also remains unchanged if the alarm is displayed in a functional diagram for a functional group.

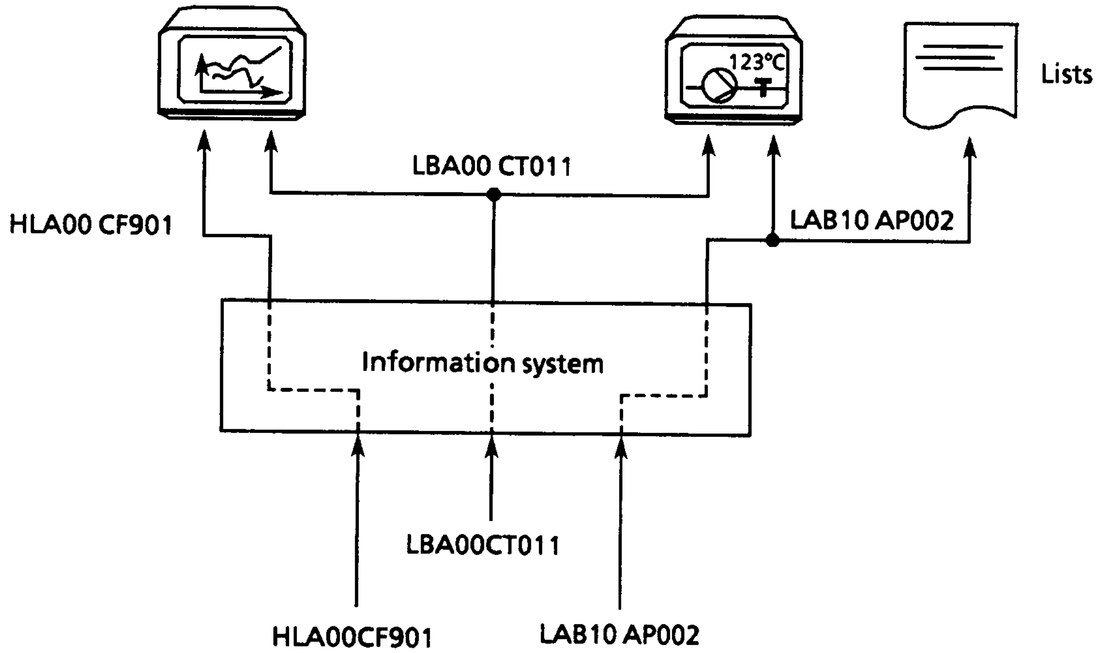
3.5.2 Process Computers

Computers are implemented for a broad spectrum of tasks covering an entire process system. The provisions of Section 3.5.1 also apply here for identification.

3.5.3 Information Systems

Some of the tasks in 3.5.1 and 3.5.2 are performed by I&C systems with special display capability in addition to processing functions. Their identification is handled as in 3.5.1 and 3.5.2.

Example 3.5.3/1: Process control via "screen-based control room"

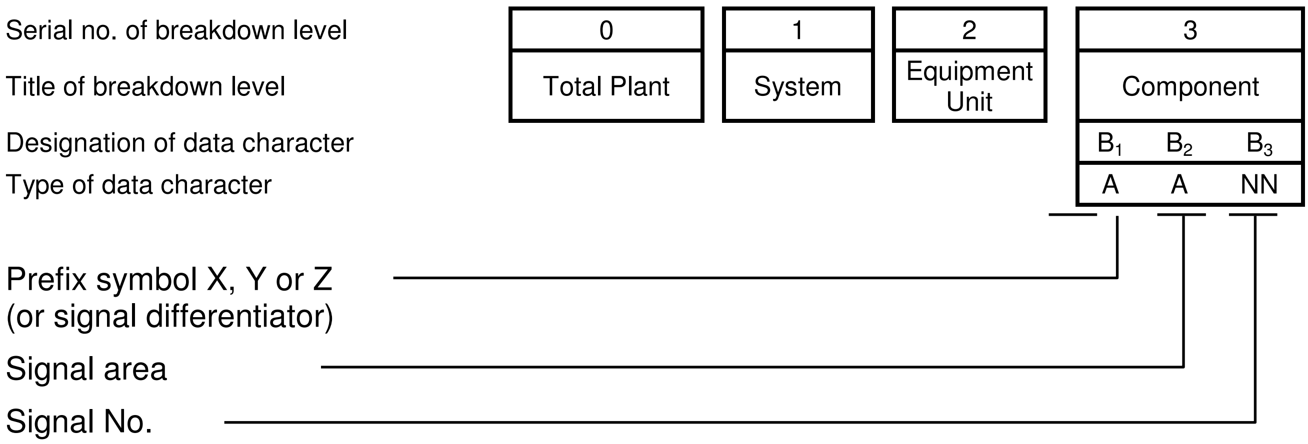


4 Identification within I&C Equipment

4.1 Signal Identification

4.1.1 General Signal Designation

To permit clear differentiation, the component code level is used for identifying the signals from measured data and signal processing identified on the system and equipment unit levels.



The initial letters X, Y and Z have the following meaning:

X	Signal origins
Y	Signal applications
Z	Gated signals

The signal areas or application areas are identified by the second alpha character. The two numerical characters which follow this specify the individual signal type or application.

As the stipulations required as a basis for signal identification depend on the hardware used and the application identifiers also depend on the documentation method employed, no generic examples are given here. Please refer to manufacturer-specific stipulations.

The identification of individual derived process variables and I&C signals is specified by agreement with those involved in the project. This identification is device-specific and manufacturer-dependent.

The following examples show how project-specific definitions can look.

a) Signal area code letters for a project

Signal area	Definition	binary analog			
A	Automatic control (group control, etc.)	binary			
B	Individual control (control interface)	binary			
C	Closed-loop control	binary			
D	Not reserved				
E	Not reserved				
F	Not reserved				
G	Conditioning of signals from contacts	binary			
H	Conditioning of signals by limit value monitors (option for "G")	binary			
J	Derived analog values	analog			
K	Not reserved				
L	Control room and control stations				
M	Alarms (individual alarms, etc.)				
N P	} Operation and monitoring } Computers and monitors }	binary analog			
Q	Analog signal conditioning	analog (binary)			
R	Not reserved				
S	Steps for open-loop control (sequencers) (option)	binary			
T	Not reserved				
U V W	} Gated signals	analog binary			
X	Not available				
Y	Not available				
Z	Not reserved	binary			

Not reserved = company-specific use
Not available = for future standardized definitions
Note: Manufacturer-specific changes are permitted

b) Standard signal number allocations (for A, B, C) for a project

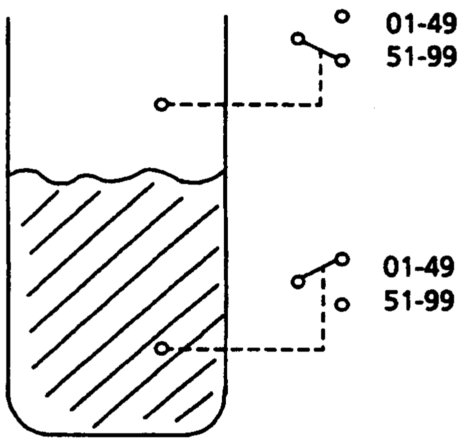
Signal No.		Signal area A	Signal area B		Signal area C
01	Checkback	ON	ON	OPEN	
02	Checkback	OFF	OFF	CLOSED	
03					
04					
05					
06					
07					
08					
09					
10					
11	Pushbutton command	ON	ON	OPEN	
12	Pushbutton command	OFF	OFF	CLOSED	
13					
14					
15	Pushbutton command	STOP		STOP	MANUAL
16					
17					
18					
19					
20					
21	Automatic command	ON	ON	OPEN	
22	Automatic command	OFF	OFF	CLOSED	
23					
24					
31	Protection command	ON	ON	OPEN	
32	Protection command	OFF	OFF	CLOSED	
33	Enable	ON			
34	Enable	OFF			
35	Disable	ON			
36	Disable	OFF			
51	Checkback		Not ON	Not OPEN	
52	Checkback		Not AUS	Not CLOSED	
53					

c) Transmitter signals (from contacts) and limit values for signal conditioning functions for a project

Code letter (signal area)

G	=	contacts	(signal conditioning for contacts)
H	=	limit values	(from analog signals) (option for "G")

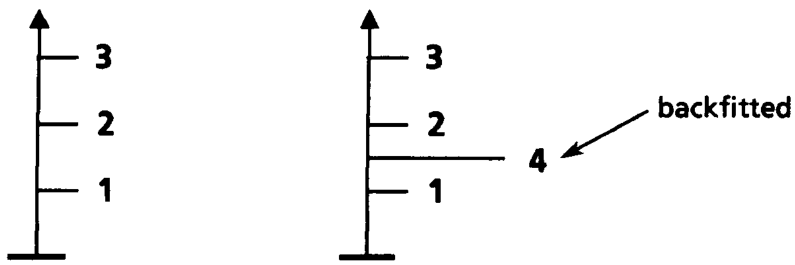
Tens position of signal numbers for transmitter contacts and limit values



- "Switching point exceeded" assigned a number less than 50
- "Below switching point" assigned a number greater than 50
- The signal numbers of inverted signals (or for changeover contacts) differ by 50, e.g. 01/51,13/63, etc.

Ones position of signal numbers

- The signal numbers are numbered sequentially from "bottom" to "top".
- In the event of changes, this sequence can be violated.

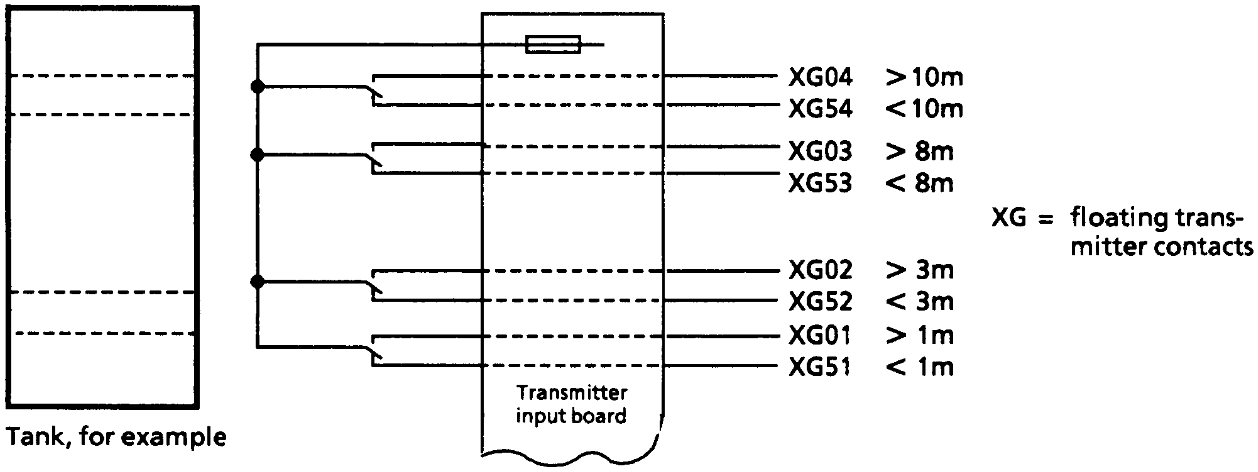


Note: Signal identification is independent of hysteresis, switching point, break current, make current, etc.

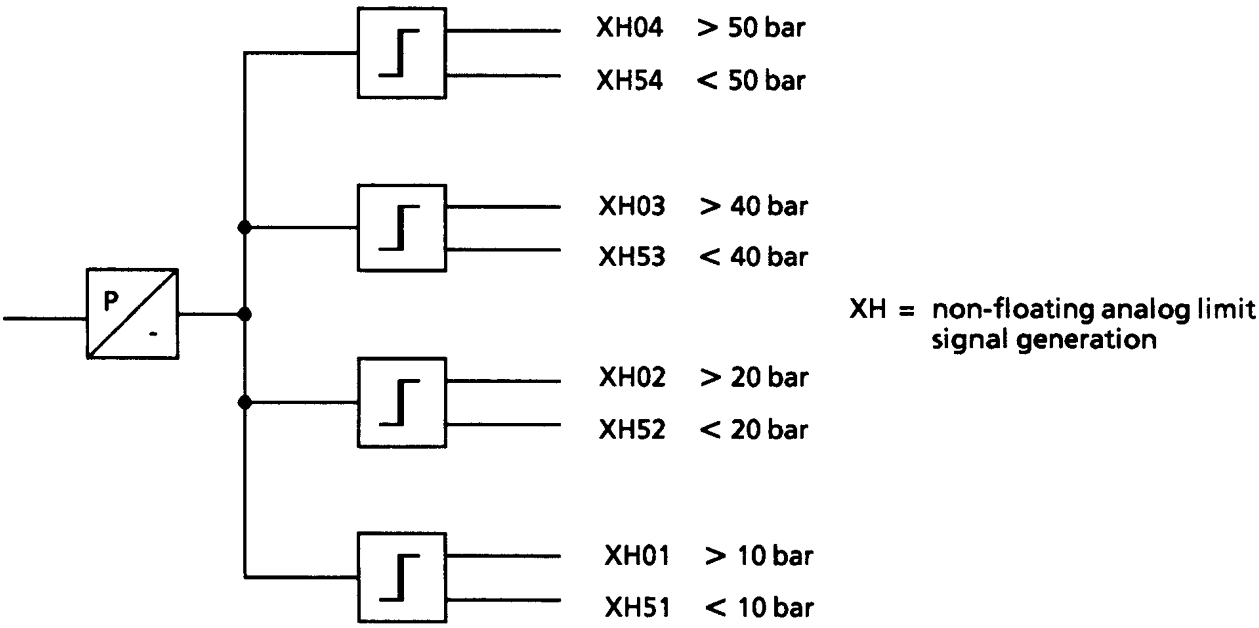
The following distinction is also made in some projects:
- uneven numbers are assigned to MAX switching points
- even numbers are assigned to MIN switching points.

For example, identification could be implemented as follows for this project:

Example 4.1.1/1: Signals which are generated by contact acquisition



Example 4.1.1/2: Signals which are formed via limit value monitors



The following distinction is also made in some projects:

- uneven numbers are assigned to MAX switching points
- even numbers are assigned to MIN switching points.

4.2 Special Identification in Programmable Logic Systems

- Software signal transfer
- Parallel processing
- Function assignment to hardware
- ... etc.

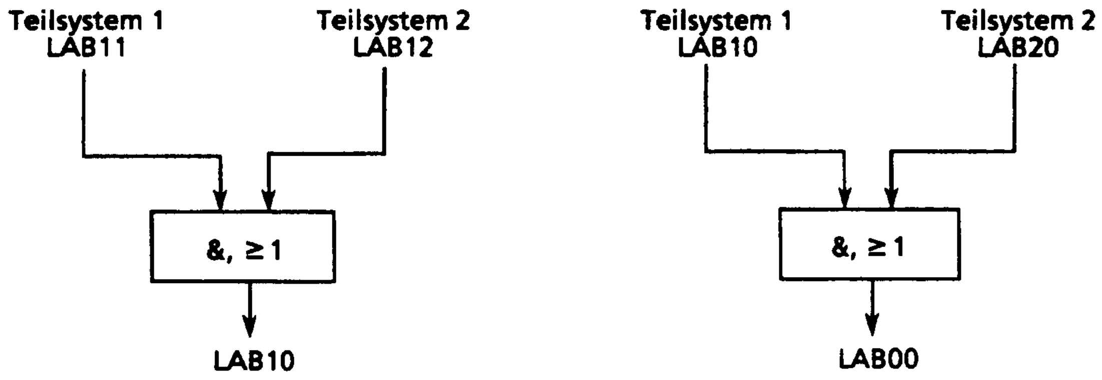
The identification is function-oriented. All of the examples given in this explanation also basically hold.

5 Identification Using Numbering Code Elements

5.1 Structure in F_N

In addition to the higher-level code possible in the alpha code elements on breakdown level 1, it is also necessary to account for common gating between individual parts of systems identified in F_N. The following F_N applications must be accounted for:

Example 5.1/1: F_N Numbering



Note: The numeric codes generated for the I&C must not conflict with those used for the process piping sections.

This method of using the numbering code elements for equipment common to different parts of systems is only possible if the numbering of piping trains in process systems is system-related. For this reason, it may be appropriate to assign the function code F_N for process systems in conjunction with coding of the mechanical equipment (see also the last two paragraphs of Part B1, Section 3.1.2).

5.2 Structure in A_N

The identification of the application goal of measuring circuits can be specified in the first digit of A_N. However, if this type of classification is implemented, the following must be observed:

- The predefined classification of similar items should be standardized in a power plant.
- Additional classification is significantly limited by the numbers available, especially if coding is also to include correlations to the equipment units for equipment unit-related measuring circuits.
- The predefined classifications should not lead to changes in the ID codes during planning, permitting codes which have already been defined to be retained.
- Project-specific definitions must be defined before the start of planning.