



RP 30-11

INSTRUMENTATION AND CONTROL - SYMBOLLOGY FOR CHEMICAL PROCESSING PLANT

October 1996

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SCOPE AND PURPOSE This Recommended Practice describes the design document for instrumentation and control used in chemical processing plant. In addition, it describes the symbology to be used in the preparation of instrumentation and control drawings. It gives examples of the documents and of the use of the symbology. The scope of this Recommended Practice does not include detailed construction drawings. The requirement for specific design documents for key equipment and systems will be specified in the relevant BP Group Recommended Practices. This Recommended Practice shall apply to all new works, including re-instrumentation projects. It shall apply to Vendor supplied packaged equipment.											
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Issued by:- Engineering Practices Group, BP International Limited, Research & Engineering Centre Chertsey Road, Sunbury-on-Thames, Middlesex, TW16 7LN, UNITED KINGDOM Tel: +44 1932 76 4067 Fax: +44 1932 76 4077 Telex: 296041											

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FOREWORD

Introduction to BP Group Recommended Practice and Specifications for Engineering

The Introductory volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

This Recommended Practice proposes a methodology which defines all drawings and documents required to fully define the Instrumentation and Control aspects during the design phase of a project. Additionally it details a consistent symbology.

Following the guidance in this Recommended Practice will ensure that all necessary data is captured and recorded in a logical and easily interpreted manner which is compatible with industry and International standards and which lends itself to electronic storage.

Qualifications to Applicability

This Guidance for Specification although a Group document has been prepared and developed by BP Chemicals and is specifically designed for use in Chemical Plants.

Application

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options. It also gives guidance on the implementation of any "Specification" or "Approval" actions; specific actions are indicated by an asterisk (*) preceding a paragraph number.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP Engineering or the Custodian. See Quarterly Status List for contacts.



1. SCOPE AND PURPOSE

1.1 Scope

This Recommended Practice describes the design document for instrumentation and control. In addition, it describes the symbology to be used in the preparation of instrumentation and control drawings. It gives examples of the documents and of the use of the symbology.

The scope of this Recommended Practice does not include detailed construction drawings.

The requirement for specific design documents for key equipment and systems will be specified in the relevant BP Group Recommended Practice.

This Recommended Practice shall apply to all new works, including re-instrumentation projects. It shall apply to Vendor supplied packaged equipment.

1.2 Structure

For the purposes of this Recommended Practice the design documents for the instrumentation and control are divided into a hierarchy with four levels, as shown in Figure 1. Generally each level of hierarchy should be developed in order as the project progresses.

1.2.1 Level 1

The level 1 drawing is the primary design drawing, the Piping and Instrumentation Diagram, P&ID.

1.2.2 Level 2

The second level documents comprises those which provide details which cannot be shown on the P&ID and those which outline the design of software systems.

The control details which cannot be shown on the P&ID are divided into,

(a) Continuous Control

Examples of continuous control schemes include advanced control, optimisers, and supervisory control.



(b) Sequence Control

Sequence control comprises a combination of continuous control and discrete control for the dedicated control of a single plant unit.

(c) Logic

The use of logic in control includes safety trips, operational interlocks and machinery control.

1.2.3

Level 3

The third level comprises key detailed design documents.

(a) Loop Drawings

Loop drawings are required to allow the design review, loop checking, and maintenance to be carried out efficiently.

(b) Process Hook Up Drawings

Process hook up drawings include the design of the process containment and therefore have safety implications.

(c) Instrument Index

The instrument index is a document central to the design of the instrumentation and is required during the design, procurement, testing, handover and operational phases of a Project.

(d) Control Systems' Functional Design Specifications

A document describing the functional design of control systems is prepared to summarise the key features and limitation of the system. It gives a high level, overall appreciation of the function of the system.

(e) Other Documents

Other key design documents are prepared for equipment and systems where specified in other BP Group Recommended Practices or when specified by BP.

1.2.4

Level 4

Level 4 documents comprise detailed construction documents and drawings and are not covered by this Recommended Practice. These documents would normally include the following, however the actual requirements shall be agreed with BP on a Project Basis:



- Instrument Data Sheets
- Instrument Layouts
- Pneumatic hook ups
- Operating Manuals
- Spares Schedules
- Hazardous area certification
- Cable tray drawings
- Calibration certificates
- Quality assurance plans
- Instrument Specifications
- Material take offs
- Software listings
- Maintenance Manuals
- Panel drawings
- Cable routings
- Termination drawings
- Junction box layouts
- Equipment specifications

2. LEVEL 1 DOCUMENTATION

2.1 P&ID

The P&ID shall include sufficient detail of the instrumentation and control to allow a basic understanding of the plant control. All instruments connected to the process shall be shown and all instruments shall be identified by a tag number.

2.2 P&ID Symbolology

Instrument symbolology for P&IDs shall be based on those given in ISA Standard, [ISA S5.1](#), "Instrumentation Symbols and Identification".

2.2.1 Examples and an explanation of all symbols and identifying letters to be used in the P&ID shall be given in the notes that accompany the P&ID. These notes shall include the expansion of any simplified representations used in the P&IDs.

2.2.2 The symbolology used for the plant P&IDs shall be used in Vendor's P&IDs for packaged equipment. This shall apply to Vendor P&IDs including HVAC packages.

2.2.3 A consistent policy shall be developed to identify those components which require identification by tag number on the P&ID.

Thermowells, orifice plates, I/P converters, need to be identified on the P&ID if it is clear to which loop they belong.

2.2.4 A consistent policy shall be developed to define the level of detail to be shown on the P&ID.

For example I/P converters for control valves and the square root extraction form orifice plate flow metering may be assumed and covered by a general note.



2.2.5 The "Use of General Instrument or Function Symbols" given in the [ISA Standard S5.1](#) shall be interpreted as follows.

- a) The "primary location normally accessible to the operator" shall mean the main control room.
- b) The "primary location not normally accessible to the operator" shall refer to back-of-panel instruments and as such shall not be used for DCS control.

Generally all DCS control is accessible either to the operator or to the engineer.

- c) The "auxiliary location normally accessible to the operator" shall refer to local panels or auxiliary control rooms.
- d) "Shared display, shared control" shall refer to the DCS, or to PLCs equipped with an operator console.
- e) "Computer function" shall refer to supervisory computers or to supervisory control in the DCS. The use of the computer function in the DCS shall refer to a software program rather the configuration of standard control blocks.
- f) "Programmable logic control" shall refer to binary logic control and sequence control, either in a PLC or in the DCS.

2.2.6 The dashed line electrical symbol is the preferred symbol and shall be applied consistently.

2.2.7 Interlocks shall be identified with the use of a full sized diamond, the letter S shall refer to safety interlocks, and I to operational interlocks. Other letters may be used, for example B for burner control, however these shall be approved by BP. An expansion, showing all overrides, alarms, and status indications, with their numbering scheme shall be included in the notes accompanying the P&ID. A number may be included in the diamond to reference the interlock to a logic diagram or cause and effect chart. The use of such a reference number shall be agreed with BP.

2.2.8 Alarms generated in the DCS shall be identified by letters outside the symbol as shown in the examples. The following letters shall be used, the use of any other method shall be approved by BP.



H	High Alarm
L	Low Alarm
Hd/dt	High rate of change alarm
Ld/dt	Low rate of change alarm
D	Deviation alarm

2.2.9 The failure action of all valves shall be shown, either symbolically or by abbreviation. Special requirements for valve shut-off tightness shall also be shown.

2.3 Instrument Numbering System

* 2.3.1 The instrument numbering system shall be approved by BP and shall be follow the guidelines given in ISA Standard, [ISA Standard S5.1](#), "Instrumentation Symbols and Identification".

2.3.2 The system shall ensure that each instrument has a unique number.

2.3.3 The maximum length of tag numbers which may be used in the DCS should be taken into account in the design of the numbering system.

2.3.4 The chosen numbering system shall apply to packaged equipment. Blocks of tag numbers should be allocated to the packaged equipment Vendors to allow them to number their instrumentation.

In general, unless the plant is small, parallel numbering should be used. Consideration should be given to using sequences of numbers to identify plant areas or the function of the instrumentation, for example local and central, regulatory, supervisory and protective.

2.3.5 Generally no attempt should be made to correlate the loop numbers with equipment numbers.

2.3.6 Consideration should be given to leaving gaps in the numbering for future use.

2.3.7 Suffixes should only be used either to identify multiple instruments in one loop eg. control valves or transmitters, or where there is spared equipment. Where both cases occur the suffix identifying the spared equipment shall be considered as part of the loop number. Only alphabetic suffixes may be used, numeric suffixes shall not be used.

2.3.8 The use of multi point type numbers shall be avoided.

2.3.9 Instruments in a DCS shall be identified as either an indicator or a controller, controllers need not be defined as indicating or recording, ;if trending is a standard feature of the DCS, ie. use TC not TIC or TRC.



- 2.3.10 Advanced control schemes shall use the general tag identifier of UC. The tag number shall match the loop controlled by the scheme and may include the loop variable to provide a unique tag.

For example, the advanced control scheme providing a setpoint to FC200 shall be tagged UFC200.

- 2.3.11 Where a loop includes several computational blocks, a suffix shall be used to identify the different blocks. To avoid confusion, if there is an I/P converter in the loop, it shall be tagged without a suffix.

For example, a flow loop may include computational blocks, FY100A, FYI00B and FYIOOC and I/P converter FYIOO.

- 2.3.12 Solenoid valves shall inherit the loop number of the valve they control and shall include the letter S to differentiate them from I/P converters ie. I/P converter FY230; solenoid valve FSY230; control valve FV230.

- 2.3.13 Shut-down valve, which are not used for control shall be identified as YV.

- 2.3.14 The tag numbers for limit switches installed to indicate the position of a control valve may use the modifiers "O" and "C" for open and closed, rather than [ISA Standard S5.1](#) "H" and "L".

- 2.3.15 Motor running indicators shall be tagged as follows;

EL If the indicator is driven by voltage or where an auxiliary contact of the motor contactor is used.

YL If the indicator is driven according to the status of the motor.

ML If M is defined as monitoring state.

- 2.3.16 The user's choice letter "B" shall be used for ESD overrides.

For example the input override for TSHH100 shall be TBSH100 and the associated alarm shall be TBAHIOO. An output defeat for signal to solenoid valve TSY100 would be tagged as TBS100 for the switch and TBL for the override indication.



3. LEVEL 2 DOCUMENTATION

3.1 Continuous Control

3.1.1 Representation

Continuous control schemes which cannot be conveniently represented on the P&ID shall be described in one of three ways: SAMA diagrams, flow charts, or block diagrams. The method used shall be defined by BP and shall be applied consistently, including packaged equipment. The use of any other method shall be approved by BP.

3.1.2 SAMA Diagrams

Continuous control schemes may be detailed using diagrams based on the Scientific Apparatus Makers Assodadon, (SAMA), Standard [RC22-11-1966](#), "Functional Diagramming of Instrument and Control Systems".

An example of the use of this method is given in Figure 3.

3.1.3 Flow charts

Flow charts shall be based on [ISO 5807-1985](#), "Information Processing - Documentation Symbols and Conventions for Data, Program and System Flowcharts, Program Network Charts and System Resources Charts".

An example of a flow chart is given in Figure 4.

3.1.4 Block Diagram

Block diagrams shall be based on [ISA Standard S5.1](#), "Instrumentation Symbols and Identification".

An example block diagram is given in Figure 5.

3.2 Sequence Control

Sequence controls cannot be conveniently represented on the P&ID. They shall be described in one of three ways: structured English, flow charts, or sequential function charts. The method used shall be defined by BP and shall be applied consistently, including packaged equipment. The use of any other method shall be approved by BP.

3.2.1 Structured English



There is no International Standard at present for Structured English, also known as psuedocode. Any extra commands shall be defined and approved by BP before use.

a) Introduction

Structured English describes a sequence using an English narrative written within a set of rules of structure and style to keep the logic clear, unambiguous, and, at the same time, detailed and uniform.

The sequence is divided into a number of named steps, chosen to correspond to logical divisions in the sequence. The logic within the step is described using statements which can either be non-executable comments or commands using standard keywords.

b) Structure

(i) Layout

Sequences shall be divided into a number of named steps and subroutines to aid in the understanding, programming and testing of the sequence. The size of each step and subroutine shall be limited to one page to aid understanding. Step names will be given on a separate line and the statements of the step will be indented. Further indentation will be used for IF/THEN/ELSE/ENDIF as described below.

(ii) Comments

Comments shall be used freely to clarify the intent of the logic. Comments shall be placed in brackets and may be on the same line as executable code or on separate lines.

(iii) Subroutines

Subroutines shall be used to simplify the logic and to improve the clarity of the programme.

(iv) Parameter List

A list of all parameters used in the programme, these should include input and output tag numbers, and internal registers and timers. The value of any constants and timers shall be given and where their values are to



be adjusted during commissioning, a typical value or range of values shall be given.

(v) Parallel Processing

Where parallel processing is required, commands to run a step in parallel with the main step shall be used.

(vi) Initialisation

Any special preconditions for the sequence shall be given, including modes of controllers, status of valves and pumps and values of process variables.

Operator access to controller, valves and pumps may be restricted while the sequence is running and this should be defined.

(vii) Failure Handling

The action to be taken on the failure of a device shall be specified, including the handling of any retries. Device failures include the failure of the processor running the sequence, of a valve, motor or controller used by the sequence. A safe fail state shall be included.

c) Keywords

(i) Output Commands

CLOSE Close the specified valve.

OPEN Open the specified valve.

START Start the specified drive.

STOP Stop the specified drive.

SET Set the mode, setpoint or output of the specified controller.

(ii) Logical Keywords

AND;OR;NOT

The logical keywords, AND, OR and NOT may be combined in one statement. To avoid confusion about the precedence of AND and OR, brackets shall be used.



(iii) Conditional Statements

IF/THEN/ELSE/ENDIF

If the IF condition is true the sequence will carry out the THEN statement, if it is false the sequence will carry out the ELSE statement. After completing either the THEN or the ELSE statement, the sequence continues from the ENDIF statement.

The IF condition can be made up of a combination of logical statements and an ELSE statement may not be required. The statements following THEN and ELSE shall be indented.

eg IF valve 101 is open

```
THEN
    STOP pump101
    CLOSE valve103
ELSE
    OPEN valve102
ENDIF
```

These statements check the status of valve 101. If it is open, the sequence stops pump101 and closes valve 103 and then proceeds with the statement following the ENDIF statement. If valve 101 is closed, the sequence does not stop pump 101 or close valve 103, instead it opens valve 102 and then proceeds to the statement following the ENDIF statement.

WAITUNTIL

The sequence does not proceed until the WAITUNTIL statement is true.

eg WAITUNTIL pressure 105 > 100 Bar

Cause the sequence to stop until pressure 105 is greater than 100 Bar.

(iv) COMMUNICATION COMMANDS

MESSAGE



Used to send a message to the operator console. If a response is required from the operator the sequence will not proceed until the operator replies.

eg. MESSAGE "OK to start heating" (YES/NO)

Will display the message, "OK to start heating?" and the sequence will wait until a yes or no answer is given.

MESSAGE "Heating started"

Will display the message, "Heating started" and the sequence will continue.

MESSAGE "Enter new value for temperature" (K1)

Will display the message, "Enter new value for temperature" and the sequence will wait until the operator enters a value. Constant K1 will then be set equal to the value entered.

LOG

Used to send a message or value to a printer.

eg. LOG "Heating started"

Will print the message "Heating started".

LOG "Temperature, (K1) Deg C reached"

Will print the message "Temperature, 100 Deg C reached" if the value of K1 is 100.

ALARM

Used to generate an alarm to the operator as defined by the system.

(v) PROGRAMMING COMMANDS

GOSUB Branches to the named subroutine.

RETURN Returns to step following the statement, GOSUB.



WAIT	Suspends the sequence for the specified time.
GOTO	Branches to the named label or step.
END	Stops the sequence until it is restarted by the operator.

START/STOP PARALLEL

The START PARALLEL command starts the parallel processing of the named step. The main and named step continue processing in parallel until the STOP PARALLEL command is reached when sequential processing of the main step recommences.

eg STEP_A

```

COMMAND
COMMAND
START PARALLEL STEP_B
=====
COMMAND          STEP_B
COMMAND          COMMAND
COMMAND          COMMAND
COMMAND          COMMAND
STOP PARALLEL    STEP_B  COMMAND
=====
COMMAND
COMMAND
```

d) Guidelines

Specific Projects, systems or processes may require additional keywords and statements, these may be used but must be clearly defined and consistently applied and shall be approved by BP prior to use.

Good Structured English should be clear and unambiguous. Careful and logical division of the sequence into steps and subroutines is essential. Clarity shall be achieved by using simple statements, sufficient comments, and avoiding negative logic and excessive nested logic.

e) Example



Use of Structured English to describe operation of batch reactor.

INITIALISE

```
LABEL1 IF      AG1 is running, OR P1 is running, OR V1 is
                open,
                OR V2 is open, OR V3 is open, OR V4 is
                closed,
                OR TC1(mode) is NOT manual, OR TC1(OP)
                is NOT 0%
                OR LS1 is high, OR PS1 is high, OR LS2 is
                low.
            THEN
```

```
                SET K1 = 1 AND GOTO MESSAGES
```

```
            ELSE
```

```
                GOTO FILL_A
```

```
            ENDIF
```

FILL_A

```
    CLOSE V4
    START PARALLEL FILL_B
    START P1
    OPEN V2
    WAITUNTIL LS1 = High
    STOP P1
    CLOSE V2
    STOP PARALLEL FILL_B
    GOTO REACTION
```

FILL_B

```
    OPEN V3
    LABEL2 START TIMER T1
    WAITUNTIL LS2 = Low OR TIMER T1 > 2 minutes
    IF TIMER T1 > 2 minutes
    THEN
        SET K1 = 2 AND GOTO MESSAGES
    ELSE
    LABEL3      CLOSE V3
    ENDIF
```



END

MESSAGES

IF K1 = 1

THEN

MESSAGE " Check set up, OK to restart?" (YES/NO)

IF YES

THEN

GOTO LABEL1

ELSE

END

ENDIF

ENDIF

IF K1 = 2

THEN

ALARM

MESSAGE "Vessel B slow to empty, reset timer?" (YES/NO)

IF YES

THEN

GO TO LABEL2

ELSE

GOTO LABEL3

ENDIF

ENDIF

END

FAIL_SAFE

AG 1 RUN

P I STOP

V1 CLOSED

V2 CLOSED

V3 CLOSED

V4 CLOSED

TC1 MAN, OP=0%

PARAMETER LIST

TAG NUMBERS

AG1 Agitator 1



P1	Pump 1
V1	Valve 1
V2	Valve 2
V3	Valve 3
V4	Valve 4
LS1	Level switch 1
LS2	Level switch 2
PS1	Pressure switch 1

INTERNAL REGISTERS

K1	Error message identifier
----	--------------------------

INTERNAL TIMERS

T1	Time for vessel B to drain
----	----------------------------

3.2.2 Flow Charts

Flow charts shall be based on [ISO 5807-1985](#), "Information Processing - Documentation Symbols and Conventions for Data, Program and System Flowcharts, Program Network Charts and System Resources Charts".

An example of a flow chart for a sequence is given in Figure 6.

3.2.3 Sequential Function Charts

Sequential function charts shall be based on IEC Standard 848, "Preparation of Function Charts for Control Systems".

An example of a sequential function chart is given in Figure 7.

3.3 Logic

3.3.1 Trips and Interlocks (Simple Logic)

- a) Simple logic used for trip and interlock functions shall be described using cause and effect charts. The chart shall identify the inputs by tag number and description and the outputs by tag number and description of the action that occurs when the trip or interlock is invoked.

An example of the layout for the cause and effect chart is given in Figure 8 connector.



- b) The category of the inputs and of the outputs shall be shown on the chart.
- c) The presence of input overrides and output defeats shall be shown on the chart.
- d) An indexing reference to assist in relating the logic with the P&IDs should be included.
- e) Where combinational logic exists, notes shall be used making reference to supporting documentation. Where the logic is simple, for example two out of three voting or a time delay on the input, notes shall be used to describe the logic

3.3.2 Trips and Interlocks (Complex Logic)

- a) For more complex logic, either flow charts or logic diagrams shall be used. The method used shall be defined by BP and shall be applied consistently, including packaged equipment. The use of any other method shall be approved by BP.
- b) Flow charts shall be based on [ISO 5807-1985](#), "Information Processing - Documentation Symbols and Conventions for Data, Program and System Flowcharts, Program Network Charts and System Resources Charts".

An example of a flow chart of an interlock is given in Figure 9.

- c) Logic diagrams shall be based on ISA Standard, [ISA Standard S5.2](#), "Binary Logic Diagrams for Process Operations".

An example of a logic diagram is given in Figure 10.

4. LEVEL 3 DOCUMENTATION

4.1 Loop Diagrams

- 4.1.1 Loop drawings shall present sufficient information on the one drawing to give an understanding of the operation of the loop and to identify all components and cabling in the loop. They shall be complete, showing the loop from its transmitter to the final device.
- 4.1.2 Loop drawings shall generally conform to [ISA Standard S-5.4](#), "Instrument Loop Diagrams".



- 4.1.3 Each loop drawing shall contain only one instrument loop. Where several transmitters form part of a loop, for example a pressure and temperature compensated flow loop, more than one transmitter will be shown on the drawing.
- 4.1.4 Loop drawings shall show and identify all devices in the loop, including cables, terminals, trip amplifiers, isolators, safety barriers, chart recorders and field indicators.
- 4.1.5 All power supplies shall be shown with the source of power, polarity and voltage level identified.
- 4.1.6 All terminations in the loop shall be shown and all terminals, cores, screens, earths and cables shall be identified. If the loop is connected to a DCS or PLC, the associated file, card and channel shall be identified.
- 4.1.7 The loop drawings shall be drawn to be legible at A3 paper size.
- 4.1.8 Cross referencing to other drawings shall be minimised.

4.2 Instrument Process Hook-Ups

- 4.2.1 Detailed instrument process hook-ups shall be prepared for all instruments. Standard drawings may be used but individual instruments shall be referenced to the relevant drawings.
- a) The hook-up drawings shall show all valves, the slope of the pipework where it is important, thermal protection requirements, draining and venting requirements.
- b) All materials and components used in the hook-ups shall be identified and described, including their rating and material.
- 4.2.2 Instrument process hook-ups shall be drawn using the symbols given in BP Group GS 108-1, "Specification for Manual and CAD Draughting".

4.3 Instrument Index

- 4.3.1 An instrument index shall be prepared and shall, as a minimum, include the following details.
- Tag number (Field and DCS if different)
 - Original Tag Number (If renumbered)
 - Description
 - Range
 - Units
 - P&ID number



- Loop drawing number
- Process hook-up drawing number
- Pneumatic hook-up drawing

4.3.2 The database should be created as a relational database and may include extra details to assist in procurement, construction, testing and handover. These additional details may include the following, which shall be agreed with BP.

- Instrument supplier
- Instrument data sheet number
- Instrument order number
- Instrument model number
- Instrument location
- Calibration certificate number
- Impulse tubing pressure test certificate number
- Impulse tubing weld test certificate numbers
- Pneumatic tubing leak test certificate
- Loop test certificate number
- Process system number
- Handover date
- Status
- Cable numbers
- Junction box numbers:
- Line number
- Fluid
- DCS display number
- Alarm priority
- Alarm group
- Hazardous area certificate numbers
- Hazardous area protection
- Piping isometric drawing number

4.4 **Functional Design Specification (System Design Specification)**

4.4.1 The overall functional design of programmable systems shall be described in a functional design specification document which would normally include the following topics, however the actual requirements shall be agreed with BP on a Project basis.

- The design philosophy
- Details of the hardware and its architecture
- System and information flow diagrams
- Lists of inputs and outputs, including addresses ranges, units and signal conditioning.



- Descriptions of alarm handling, data storage, operator interfaces, reporting, logging, diagnostics, programs, standard program modules, editing facilities.
- Details of power supplies and earthing arrangements
- Cabinet layouts and interconnecting cabling
- Quality plan
- Weights, sizes, environmental requirements and power requirements

4.4.2 System and information flow diagrams show the logic and information flow within a software system and give a high level overall appreciation of the software or system. They may be used as the basis for design of software and computer systems and to illustrate the design to non experts.

4.4.3 System and information flow diagrams shall be based on [ISO 5807-1985, Information Processing - Documentation Symbols and Conventions for Data, Program and System Flowcharts, Program Network Charts and System Resources Charts](#)”.

An example of a flow chart is given in Figure 11.

5. INTEGRATED DESIGN SYSTEMS

Consideration shall be given to the use of integrated design systems to assist in the preparation of the documentation.

There are several software systems available covering different aspects of design.



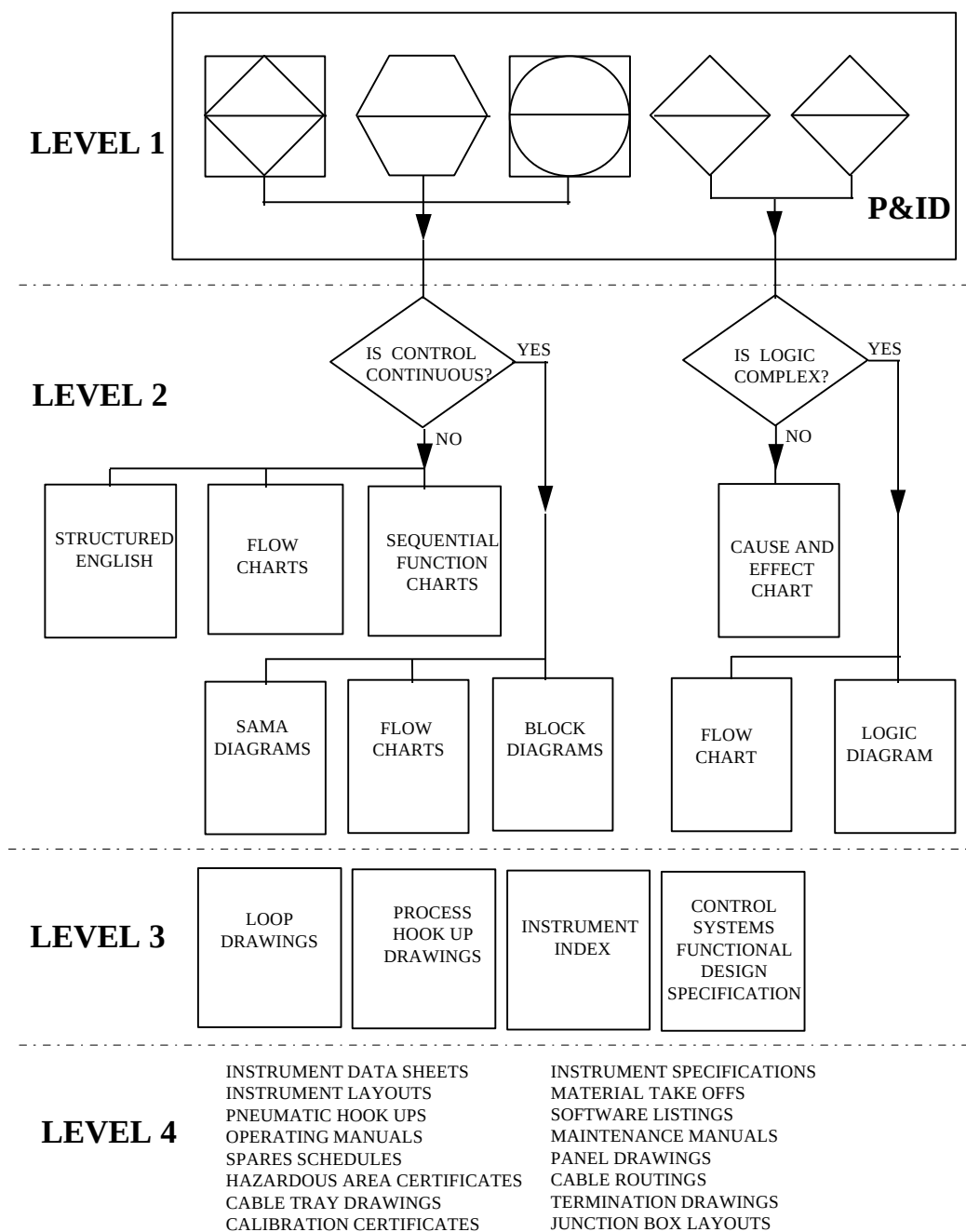


FIGURE 1

HIERARCHY OF DOCUMENTATION



	LOCAL OR FIELD	PRIMARY LOCATION		AUXILIARY LOCATION	
		NORMALLY ACCESSIBLE OPERATOR	NOT NORMALLY ACCESSIBLE TO OPERATOR	NORMALLY ACCESSIBLE OPERATOR	NOT NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS					
SHARED DISPLAY/ SHARED CONTROL					
COMPUTER FUNCTION/ SOFTWARE CODING					
LOGIC/SEQUENTIAL CONTROL					

- NOTES:
- COMPUTATIONAL BLOCK IMPLEMENTED IN DCS (LOW SELECT)
 - HIGH AND LOW LEVEL ALARMS, GENERATED IN DCS
 - OPERATIONAL INTERLOCK
 - SAFETY INTERLOCK
 - EXAMPLES OF EXPANSION OF OVERRIDES, DEFEATS, ALARMS AND STATUS FOR INTERLOCK SYSTEMS

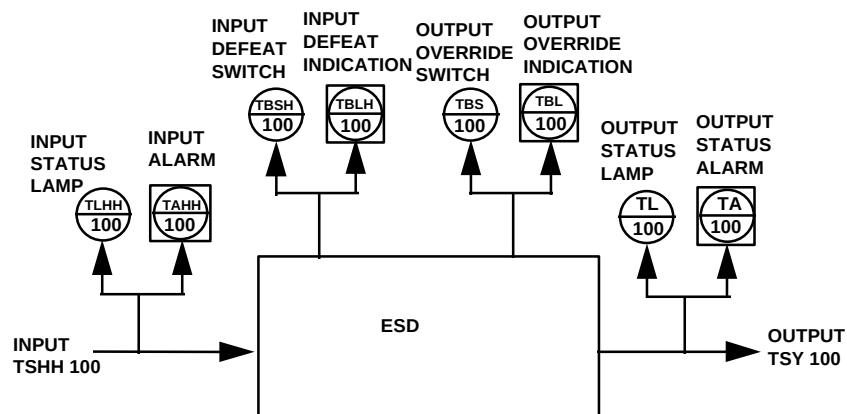


FIGURE 2A
INSTRUMENT SYMBOLOGY FOR P&ID

	WEIGHT/FORCE	ANALYSIS	FLOW RATE	FLOW RATIO	LEVEL	PRESSURE	PRESSURE DIFFERENTIAL	TEMPERATURE	TEMPERATURE DIFFERENTIAL	SPEED/FREQUENCY	CURRENT	DENSITY	TIME	UNDESIGNATED	POSITION
ELEM ENT	WE	AE	FE	FFE	LE	PE	PDE	TE	TDE	SE	IE	DE	KE	XE	ZE
INDICATOR	WI	AI	FI	FFI	LI	PI	PDI	TI	TDI	SI	II	DI	KI	XI	ZI
TRANSMITTER	WT	AT	FT	FFT	LT	TT	PDT	TI	TDT	ST	IT	DT	KT	XT	ZT
RECORDER	WR	AR	FR	FFR	LR	PR	PDR	TR	TDR	SR	IR	DR	KR	XR	ZR
INDICATING CONTROLLER	WIC	AIC	FIC	FFIC	LIC	PIC	PDIC	TIC	TDIC	SIC	IIC	DIC	KIC	XIC	ZIC
RECORDING CONTROLLER	WRC	ARC	FRC	FFRC	LRC	PRC	PDRC	TRC	TDRC	SRC	IRC	DR C	KRC	XRC	ZRC
SHARED DISPLAY CONTROLLER	WC	AC	FC	FFC	LC	PC	PDC	TC	TDC	SC	IC	DC	KC	XC	ZG
SOLENOID VALVE	WSY	ASY	FSY	FFSY	LSY	PSY	PDSY	TSY	TDSY	SSY	ISY	DSY	KSY	XSY	ZSY
CONTROL VALVE	WV	AV	FV	FFV	LV	PV	PDV	TV	TDV	SV			KV	XV	ZV
CONTROL VALVE, SELF ACTING	WCV	ACY	FCV	FFCV	LCV	PCV	PDCV	TCV	TDCV	SCV	ICV	DCV	KCV	XCV	ZCV
SWITCH LOW	WSL	ASL	FSL	FFSL	LSL	PSL	PDSL	TSL	TDSL	SSL	ISL	DSL	KSL	XSL	ZSL
SWITCH HIGH	WSH	ASH	FSH	FFSH	LSH	PSH	PDSH	TSH	TDSH	SSH	ISH	DSH	KSH	XSH	ZSH
ALARM LOW	WAL	AAL	FAL	FFAL	LAL	PAL	PDAL	TAL	TDAL	SAL	IAL	DAL	KAL	XAL	ZAL
ALARM HIGH	WAH	AAH	FAH	FFAH	LAH	PAH	PDAH	TAH	TDAH	SAH	IAH	DAH	KAH	XAH	ZAH
SWITCH LOW LOW	WSLL	ASLL	FSL	FFSLL	LSLL	PSLL	PDSLL	TSL	TDSLL	SSL	ISLL	DSLL	KSLL	XSLL	ZSLL
SWITCH HIGH HIGH	WSHH	ASHH	FSHH	FFSHH	LSHH	PSHH	PDSHH	TSHH	TDSHH	SSHH	ISHH	DSHH	KSHH	XSHH	ZSHH
ALARM LOW LOW	WALL	AALL	FALL	FFALL	LALL	PALL	PDALL	TALL	TDALL	SALL	IALL	DALL	KALL	XALL	ZALL
ALARM HIGH HIGH	WAHH	AAHH	FAHH	FFAHH	LAHH	PAHH	PDAHH	TAHH	TDAHH	SAHH	IAHH	DAHH	KAHH	XAHH	ZAHH
RELAY/CONVERTOR/COMPUTATION	WY	AY	FY	FFY	LY	PY	PDY	TY	TDY	SY	IY	DY	KY	XY	ZY
LIGHT	WL	AL	FL	FFL	LL	PL	PDL	TL	TDL	SL	IL	DL	KL	XL	ZL
ADVANCED CONTROL	UWC	UAC	UFC	UFF C	ULC	UPC	UPDC	UTC	UTDC	USC	UIC	UDC	UKC	UXC	UZC
INTEGRATING INDICATOR	WQI	AQI	FQI	FFQI	LQI	PQI	PDQI	TQI	TDQI	SQI	IQI	DQI	KQI	XQI	ZQI

FIGURE 2B

EXAMPLE OF AN INFORMATION FLOW DIAGRAM



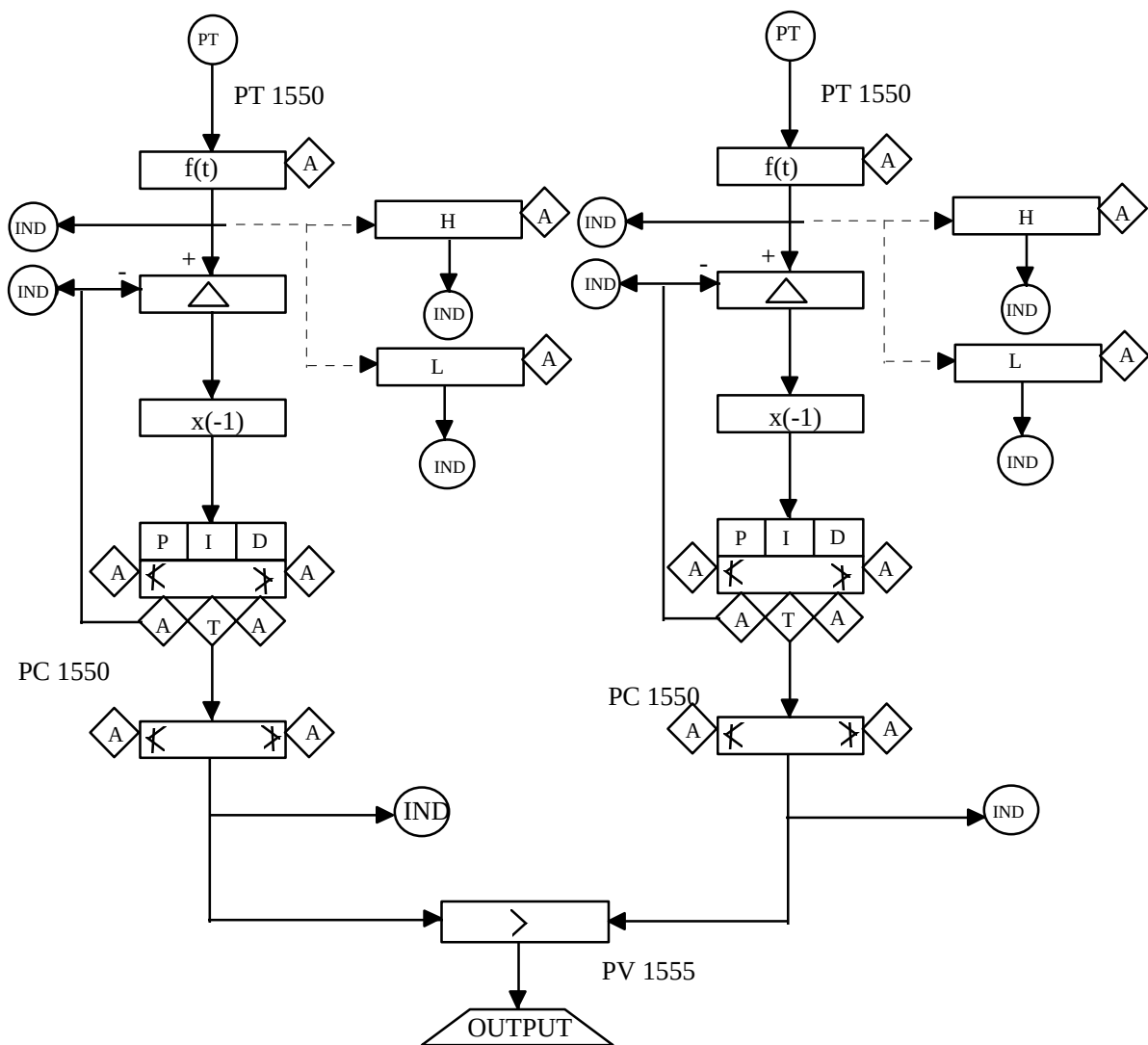


FIGURE 3

EXAMPLE OF SAMA DIAGRAM FOR CONTINUOUS CONTROL



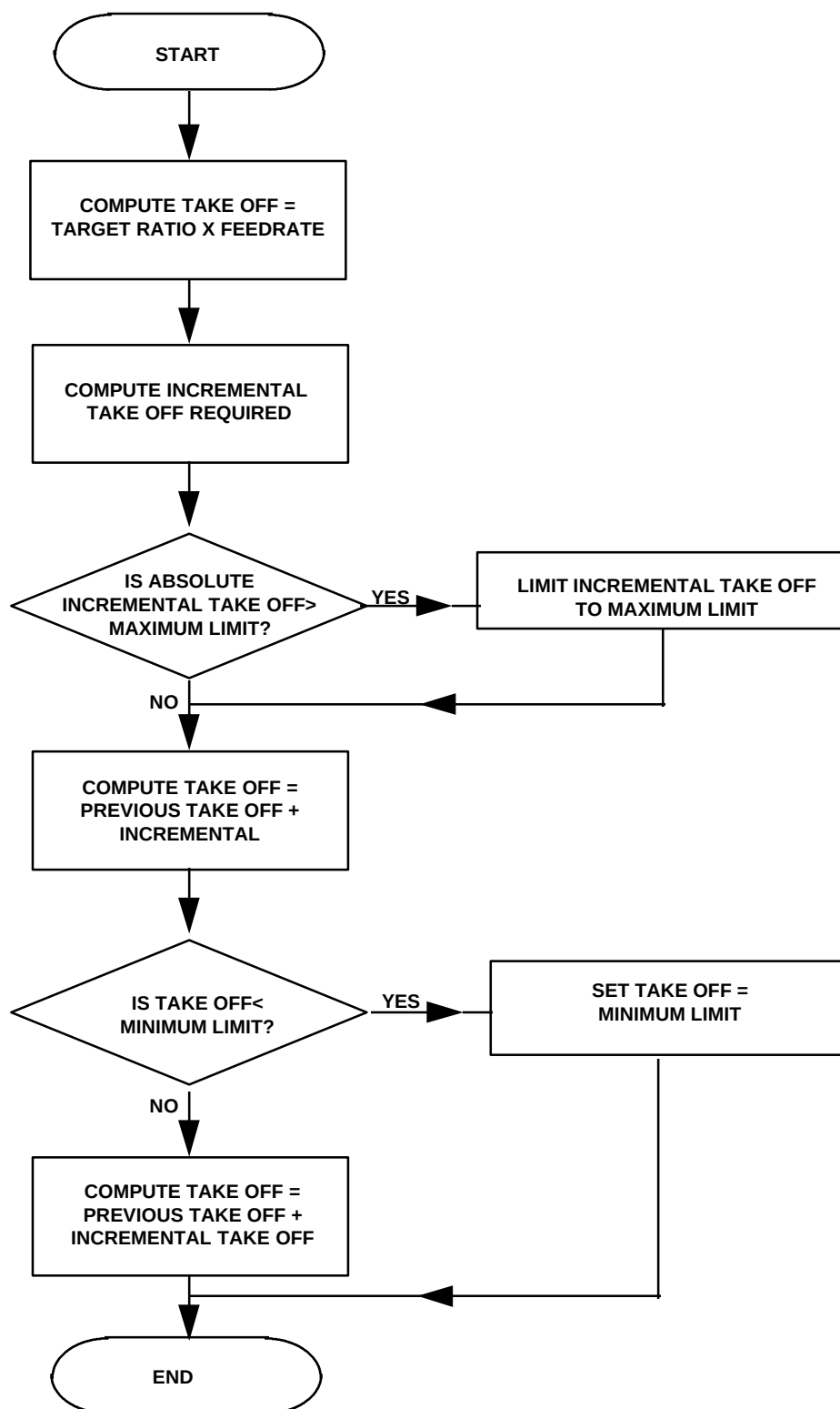


FIGURE 4

EXAMPLE OF A CONTINUOUS FLOW CONTROL CHART

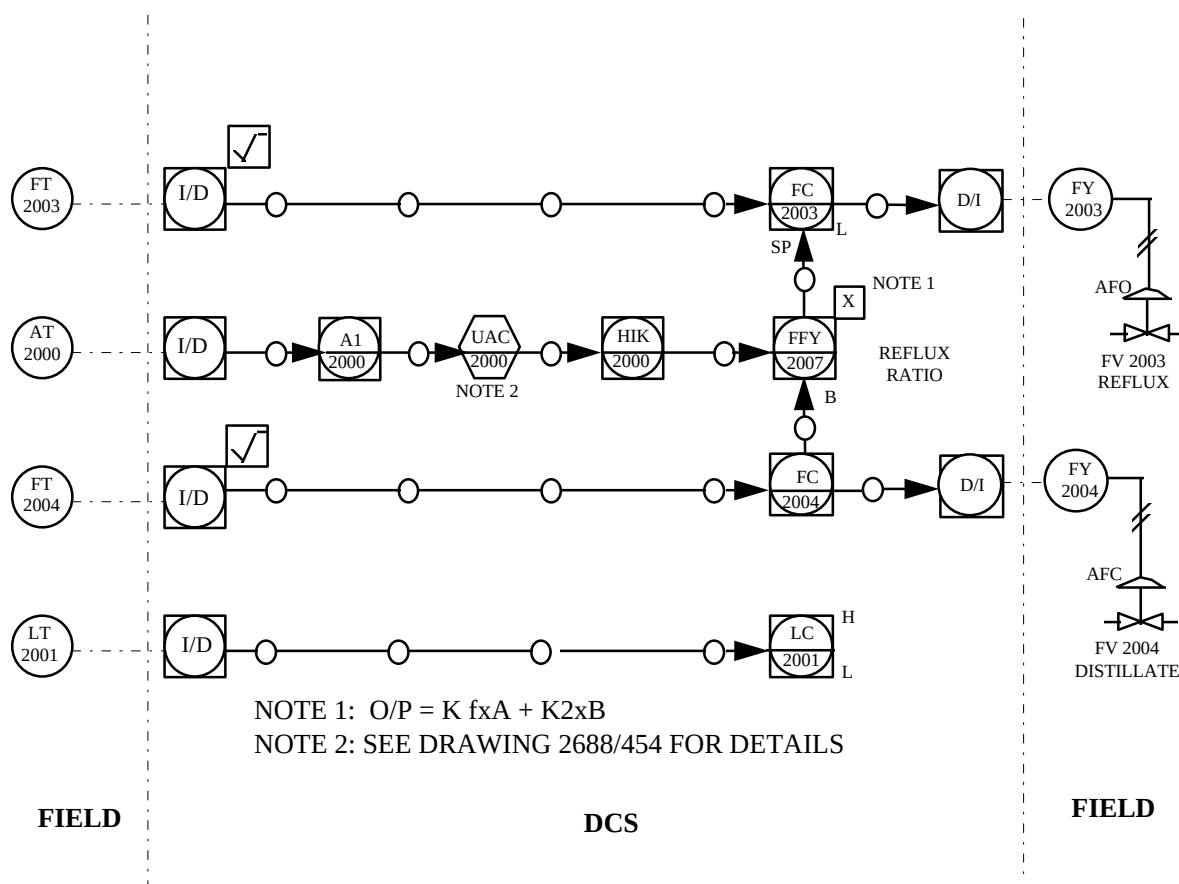


FIGURE 5

EXAMPLE OF A BLOCK DIAGRAM FOR CONTINUOUS CONTROL

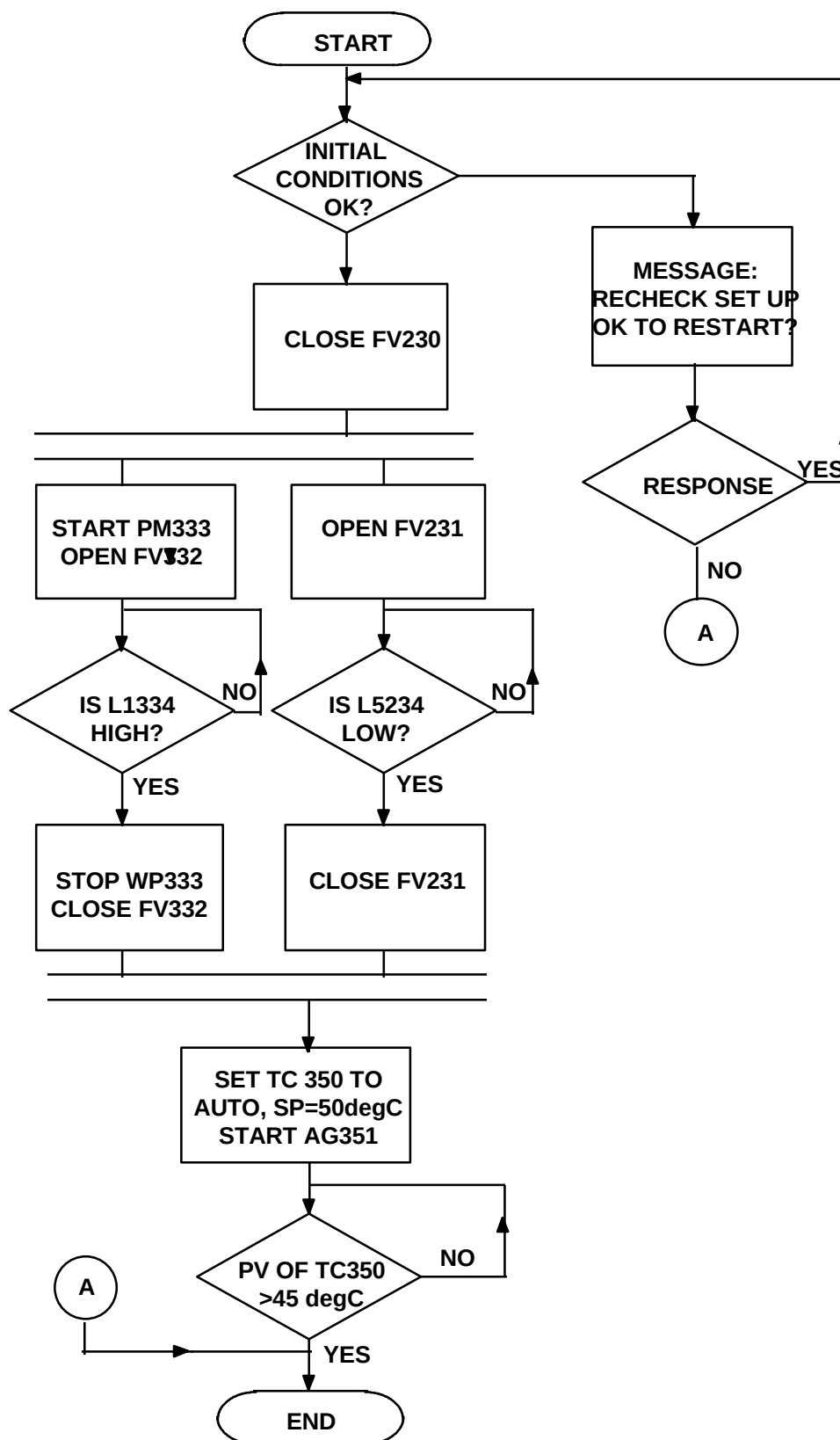


FIGURE 6
EXAMPLE OF A FLOW CHART FOR A SEQUENCE

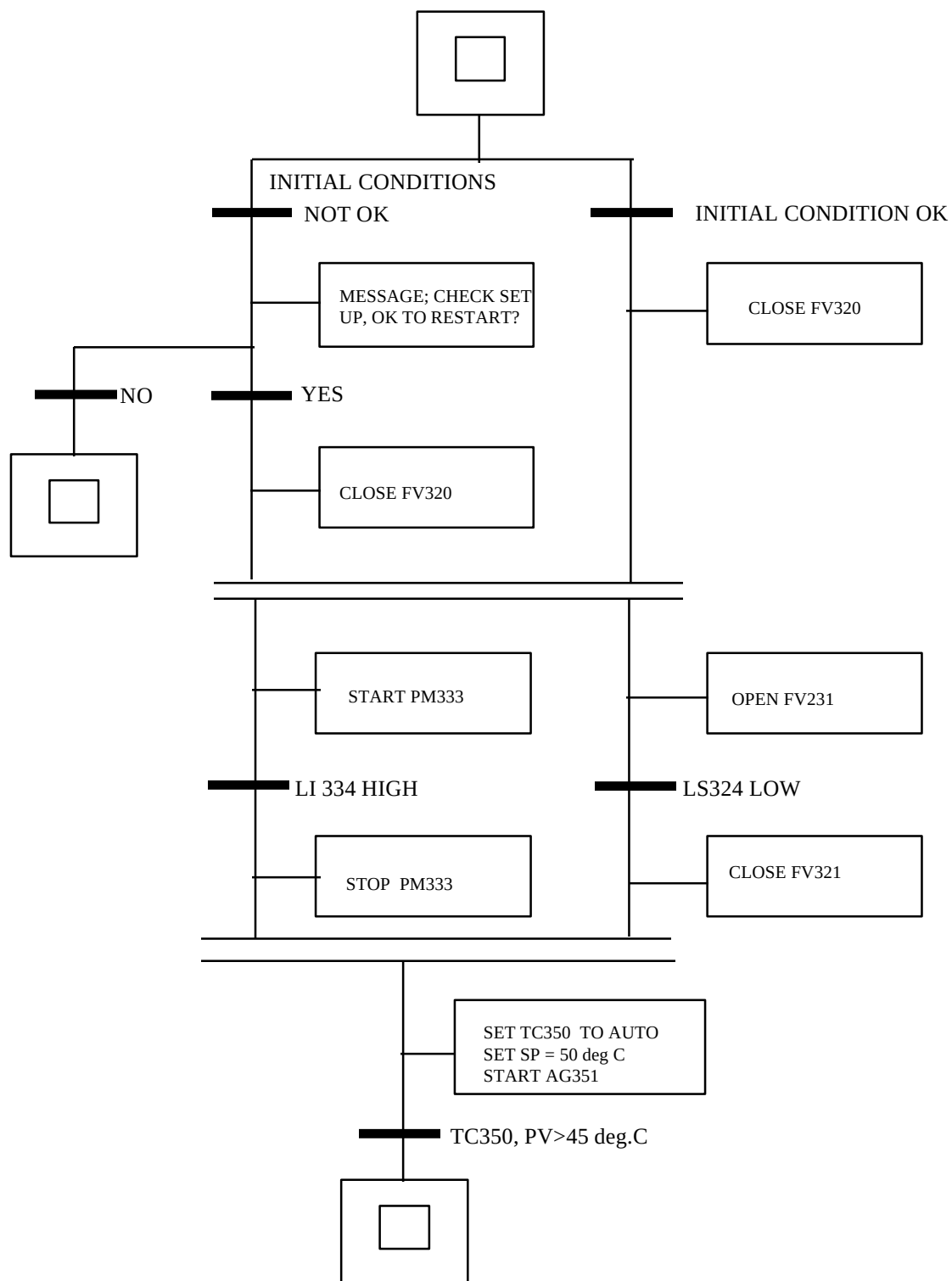


FIGURE 7
EXAMPLE OF SEQUENTIAL FUNCTION CHART

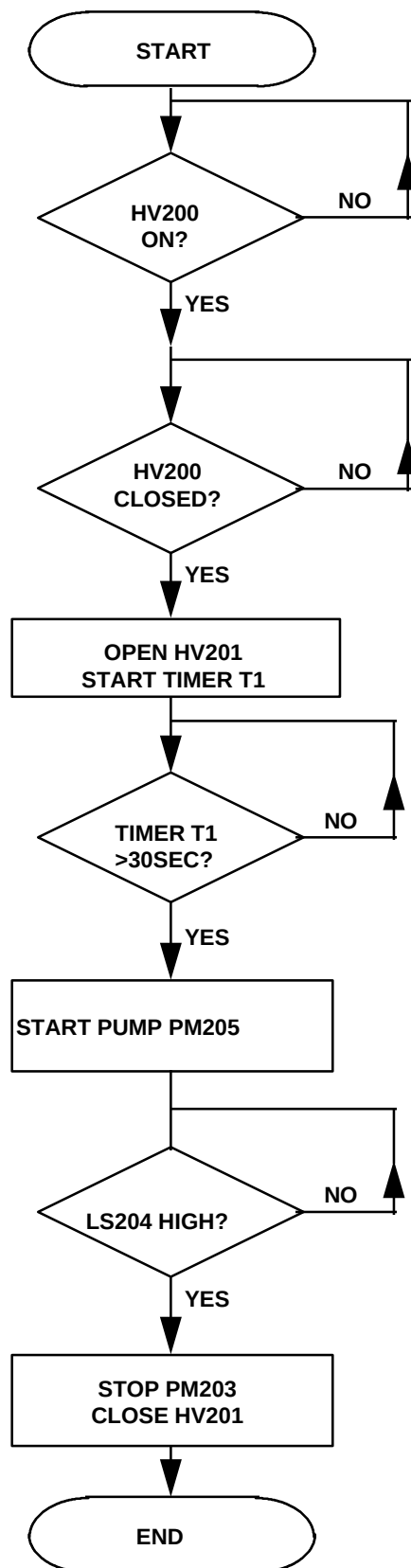


FIGURE 9
EXAMPLE OF FLOW DIAGRAM FOR LOGIC

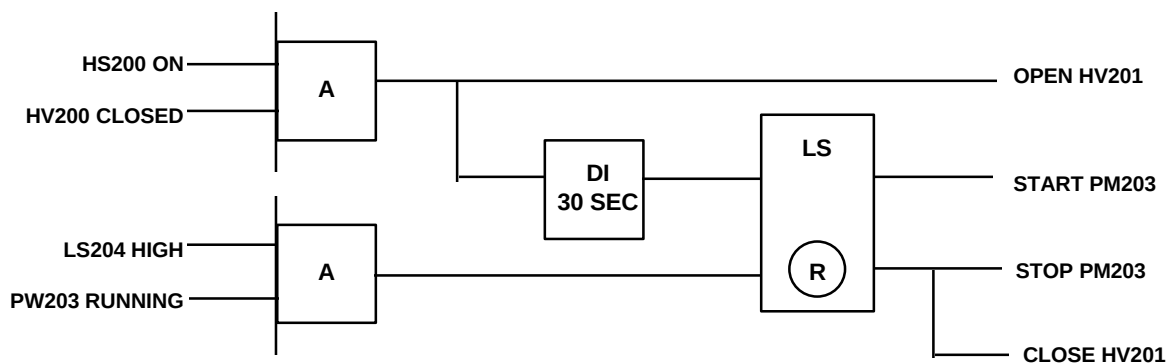


FIGURE 10
EXAMPLE OF LOGIC DIAGRAM

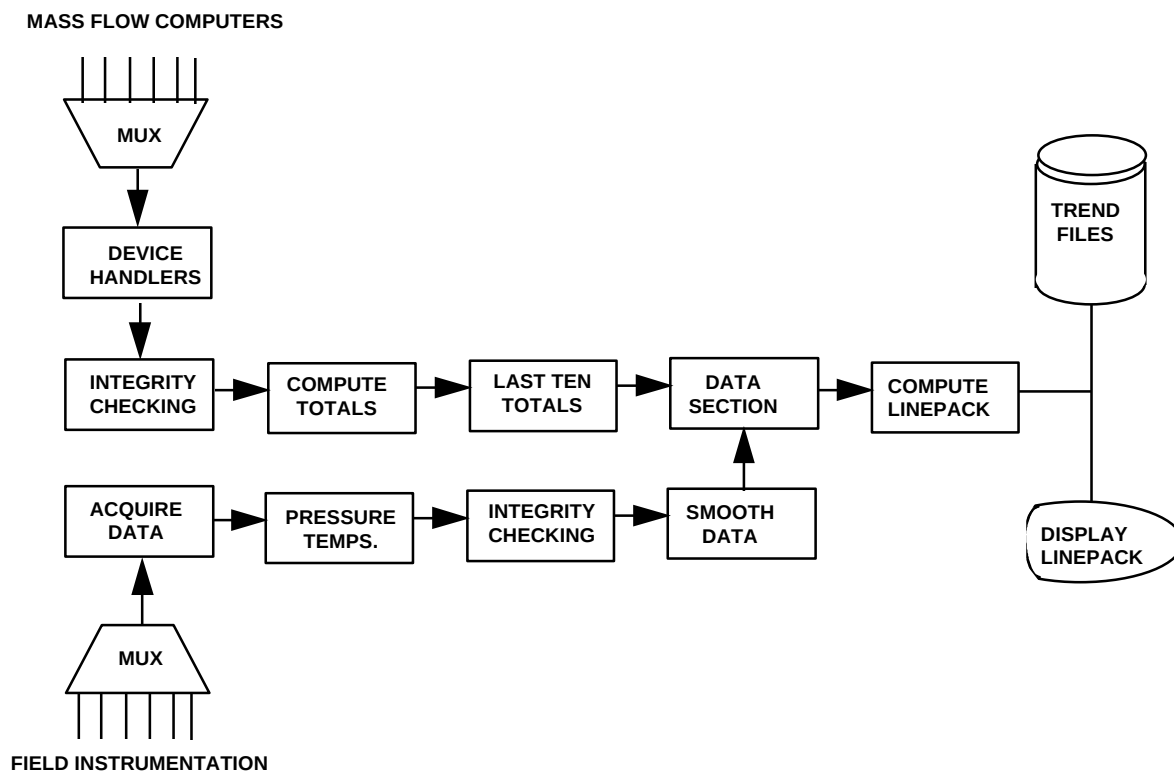


FIGURE 11
EXAMPLE OF AN INFORMATION FLOW DIAGRAM



DEFINITIONS AND ABBREVIATIONS**Definitions**

Standardised definitions may be found in the BP Group RPSEs Introductory volume.

Abbreviations

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
DCS	Digital Control System
HVAC	Heating & Ventilation and Air Conditioning
ISA	Instrument Society of America
P&ID	Piping and Instrumentation Diagram
PLC	Programmable Logic Controller
TC	Temperature Controller
TIC	Temperature Inducting Controller
TRC	Temperature Recording Controller



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

International Standards

ISO 5807 (BS 4058)	Information Processing - Documentation Symbols and Conventions for Data, Program and System Flowcharts, Program Network Charts and System Resources Charts
IEC 848	Preparation of Function Charts for Control Systems

American Industry Documents

ISA Standard S5.1	Instrument Symbols and Identification
ISA Standard S5.2	Binary Logic Diagrams for Process Operations
ISA Standard S5.4	Instrument Loop Diagrams

British Industry Documents

RC22-11	Functional Diagramming of Instrument and Control Systems
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BP Group Documents

GS 108-1	Specification Manual for CAD Drafting
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