Functional Diagramming
of Instrument and Control Systems
Analog and Digital Control Systems

Published 1981

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1. SCOPE AND PURPOSE

1.1 This standard presents both symbols and diagramming format for use in representing measuring, controlling and computing systems.

1.2 The purpose of this standard is to establish uniformity of symbols and practices in diagramming such systems in their basic functional form, exclusive of their operating media or specific equipment detail.

1.3 The flexibility of the symbols and format, however, provides for development of diagrams that display easily understandable equipment relationships for either analog or digital systems.

2. INTRODUCTION

2.1 To clarify the type of diagram with which this standard is concerned it is assumed that in designing a complex measuring, control or computational system the following types of diagrams will be required:

a) functional diagrams
b) detailed schematic diagrams
c) interconnection diagrams
d) ISA Process & Instrumentation (P&I) Diagrams

This standard is concerned only with the functional diagram normally prepared in the early stages of system conception from the mechanical or process flow sheet. It normally is revised and kept current with concept as system design progresses through the various stages of negotiation, quotation, contract award, reduction to final equipment, system checkout and installation, and ultimately becomes a part of the systems instructions, representing at all times the system function.

The detailed schematic diagram will be generated from the functional diagram and will detail the actual equipment connections in the system.

The interconnections diagram will detail the external field interconnections.

This type of functional diagramming can be used as insets to further clarify the P & I diagram.

2.2 The symbols have been kept as simple as possible and the variety held to a minimum. Complex functions are represented by the combinations of the basic symbols.

3. SOURCES AND REFERENCES

3.1 Existing symbols and terms have been used wherever practical.

3.2 Source and reference documents are as follows:

ANSI Standard C35.1
“Terminology for Automatic Control” published by the American Society of Mechanical Engineers, copyright 1963

ISA S5.1
“Instrumentation Systems and Identification”, published by the Instrument Society of America, copyright 1963

ISA S5.2
“Binary Logical Diagrams for Process Operations”, published by the instrument Society of America, copyright 1976

ISA S5.3
“Flow Diagram Graphic Symbols for Distributed Control Shared Display Instrumentation Logic and Computer Systems” (submitted to ANSI-1981)

ISA S5.4
“Instrument Loop Diagrams”, published by the Instrument Society of America, copyright 1976

ISA S51.1
“Process Instrumentation Terminology”, published by the Instrument Society of America, copyright 1976

SAMA Standard PMC 20.1
“Measurement and Control Terminology”, published by the Process Measurement & Control Section, SAMA, copyright 1973

INSTRUMENT AND CONTROL SYSTEMS

4. PREPARATION OF FUNCTIONAL DIAGRAMS

4.1 Symbols

A complete symbol consists of both an enclosure and a signal processing symbol, except as noted below. Ten specific shapes of enclosures representing the measuring or readout, automatic signal processing, manual signal processing and final controlling functions are used. Within the enclosure symbol, mathematical expressions or capital letters are used.

4.1.1 Signal Processing Symbols

Signal processing symbols are listed in Figure 1.

Appendix A presents expanded definitions of the functions represented by the symbols.

Figure 1. Signal Processing Symbols

FUNCTION	SIGNAL PROCESSING SYMBOL
SUMMING	$\sum$ or +
AVERAGING	$\sum$ n
DIFFERENCE	Δ or −
PROPORTIONAL	K or P
INTEGRAL	$\int$ or I
DERIVATIVE	d/dt or D
MULTIPLYING	X
DIVIDING	÷
ROOT EXTRACTION	n ——
EXPONENTIAL	X^n
NON-LINEAR FUNCTION	f(x)
TRI-STATE SIGNAL (RAISE, HOLD, LOWER	↕
INTEGRATE OR TOTALIZE	Q
HIGH SELECTING	>
LOW SELECTING	<
HIGH LIMITING	⊳
LOW LIMITING	⊲
REVERSE PROPORTIONAL	-K or -P
VELOCITY LIMITING	V⊳
BIAS	±
TIME FUNCTION	f(t)
VARIABLE SIGNAL GENERATOR	A
TRANSFER	T
SIGNAL MONITOR	H/, H/L, /L

FUNCTION		SIGNAL PROCESSING SYMBOL
LOGICAL SIGNAL GENERATOR		B
LOGICAL AND		AND
LOGICAL OR		OR
QUALIFIED LOGICAL OR n – an integer	> n	GTn
	< n	LTn
	= n	EQn
LOGICAL NOT		NOT

SET MEMORY	S, SO
RESET MEMORY	R, RO
PULSE DURATION	PD
PULSE DURATION OF THE LESSER TIME	LT
TIME DELAY ON INITIATION	DI or GT
TIME DELAY ON TERMINATION	DT

INPUT/OUTPUT	ANALOG	A
	DIGITAL	D
	VOLTAGE	E
SIGNAL CONVERTER	FREQUENCY	F
	HYDRAULIC	H
	CURRENT	I
Examples: D/A I/P	ELECTRO MAGNETIC OR SONIC	O
	PNEUMATIC	P
	RESISTANCE	R

User defined signal processing symbols may be used provided both of the following requirements are met:

1) The symbol must consist of letters or accepted symbols in common usage.

2) The symbol is precisely and unambiguously defined in the user drawings according to the format of Appendix A, or as defined in ISA S5.1.

4.1.2 Enclosure Symbols

Enclosure symbols are listed in Figure 2.

4.1.2.1 Circle for Measuring or Readout Function

Within this enclosure, a symbol is used to identify the function or service or both. This may consist of letters from ISA S5.1 or user defined Table I of Functions per paragraph 4.1.1.

4.1.2.2 Rectangle for Automatic Signal Processing Function

Within this enclosure, a symbol from Figure 1 or additional system defined on the drawing may be used.

4.1.2.3 Diamond for Manual Signal Processing Function

Within this enclosure, the symbol A, B or T from Figure 1 is to be used.

4.1.2.4 Isoceles Trapezoid for Final Controlling Function

Within this enclosure, a symbol is used to identify the function or service or both. This may consist of letters, words, or accepted symbols in common usage, including those of Figure 1 or user defined symbol.

A rectangle on the top denotes a positioner.

4.1.2.5 Square for Timers

See Appendix A for the configurations of the Timers.

4.1.2.6 Logic and Memory Symbols

4.1.2.7 See Appendix A for the detailed definition of these functions.

4.1.3 Processed Signal Continuation Symbols

Processed signal continuation symbols are listed in Figure 3. These symbols represent signal continuation of any nature (voltage, pneumatic, or soft wired digital link). Users may make the distinction provided it is accompanied by a definition on the drawing.

4.1.4 Examples of Usage

Examples are given in Appendix B to illustrate the use and combination of symbols.

4.2 Diagram Format

The diagram format can be vertical or horizontal. Vertical is preferred.

4.2.1 Vertical Format

In the vertical format, the measuring functions are located at the top with the flow of the diagram downward. The signal processing and manual functions are in the center area and the final control functions are at the bottom. (Figure 4.)

In general, the main signals enter at the top of the symbol enclosures (input) and leave at the bottom (output).

Auxiliary functions such as manual operations, set point, biasing, etc., enter the symbol enclosure at either side. Arrowheads are used for clarity.

If desired, input signals for readout functions can be taken off horizontally from the point of desired measurement.

4.2.2 Horizontal Format

In the horizontal format, the measuring functions are located at the left with the flow of the diagram to the right. The signal processing and manual functions are in the center area and the final control functions are at the right. (Figure 5).

In general, the main signals enter at the left of the symbol enclosure (input) and leave at the right (output).

Auxiliary functions such as manual operations, set point, biasing, etc., enter the symbol enclosure at either the top or bottom. Arrowheads are used for clarity.

If desired, input signals for readout functions can be taken off vertically from the point of desired measurement.

4.2.3 Multiple Use Functions

Multiple use functions are shown only once on the diagram with connecting lines or reference notes used to indicate connections to other parts of the diagram or system. (Figure 4 Flow A).

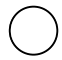
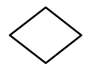
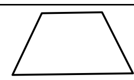
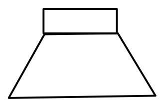
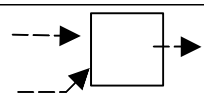
4.2.4 Combination of Symbols

Each specific function represented by a symbol is drawn in a separate enclosure. To show equipment arrangement any number of specific symbols, hence functions, that are provided by a single instrument are attached to each other without interconnecting lines. Thus, the function of a given system may be diagrammed with or without regard to any particular equipment configuration. (Figure 6A and 6B).

4.2.5 Diagramming Flexibility

The amount of detail displayed depends on the purpose intended for the diagram. Simplified diagrams can be drawn by omitting details that may be obvious, e.g.: the manual signal portion of the manual transfer function could be omitted (Figures 6A and 6B) if the function or application description would be obscured by such hardware details.

Figure 2. Enclosure Symbols

FUNCTION	ENCLOSURE SYMBOL
MEASURING OR READOUT	
MANUAL SIGNAL PROCESSING	
AUTOMATIC SIGNAL PROCESSING	
FINAL CONTROLLING	
FINAL CONTROLLING WITH POSITIONER	
TIME DELAY OR PULSE DURATION	 optional reset

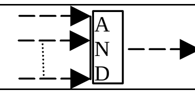
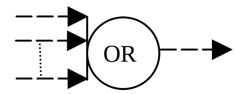
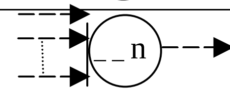
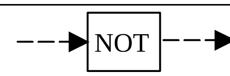
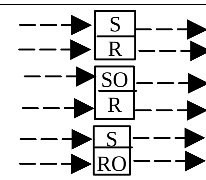
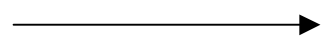
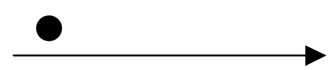
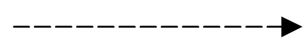
FUNCTION	ENCLOSURE SYMBOL
LOGICAL AND	
LOGICAL OR	
QUALIFIED LOGICAL OR	
LOGICAL NOT	
MAINTAINED MEMORY	

Figure 3. Processed Signal Continuation Symbols

SIGNAL	SYMBOL
CONTINUOUSLY VARIABLE SIGNAL	
INCREMENTAL CHANGE SIGNAL OR RATE OF CHANGE OF A CONTINUOUSLY VARIABLE SIGNAL	
ON – OFF SIGNAL *	

* The on – off signal symbol may be a solid line if on a separate digital logic diagram or if on an inset detail on a functional diagram

Figure 4 –Vertical Format

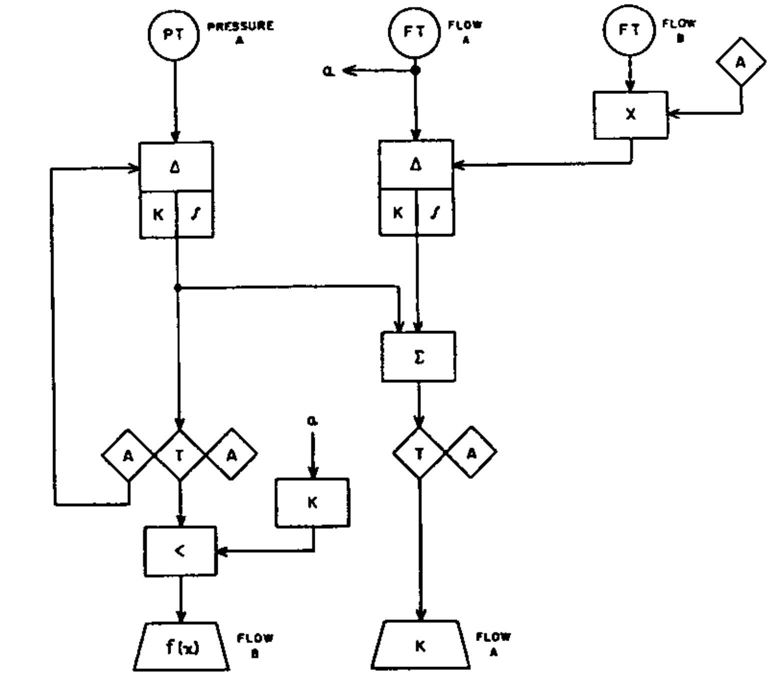


Figure 5 –Horizontal Format

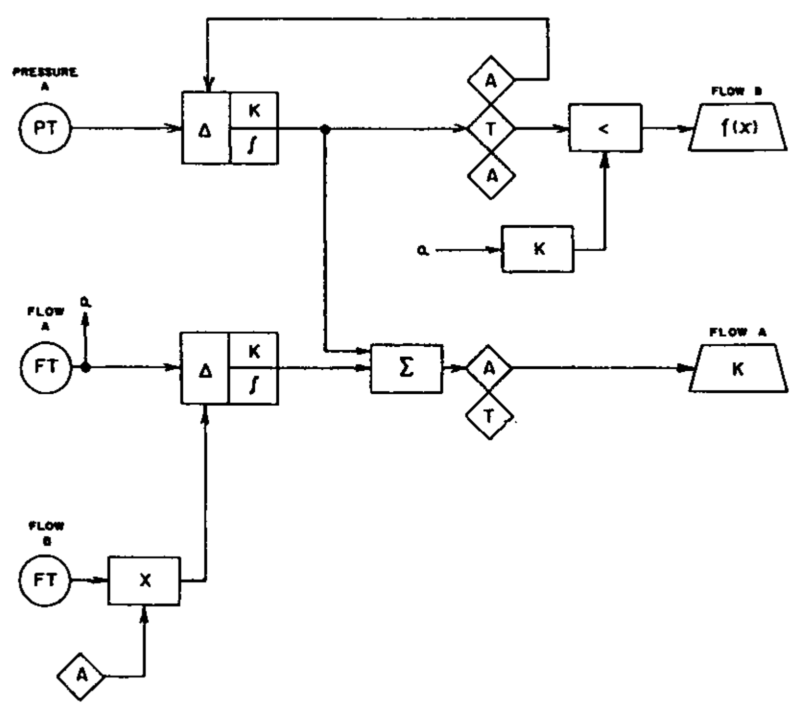


Figure 6A —Functional Oriented Format

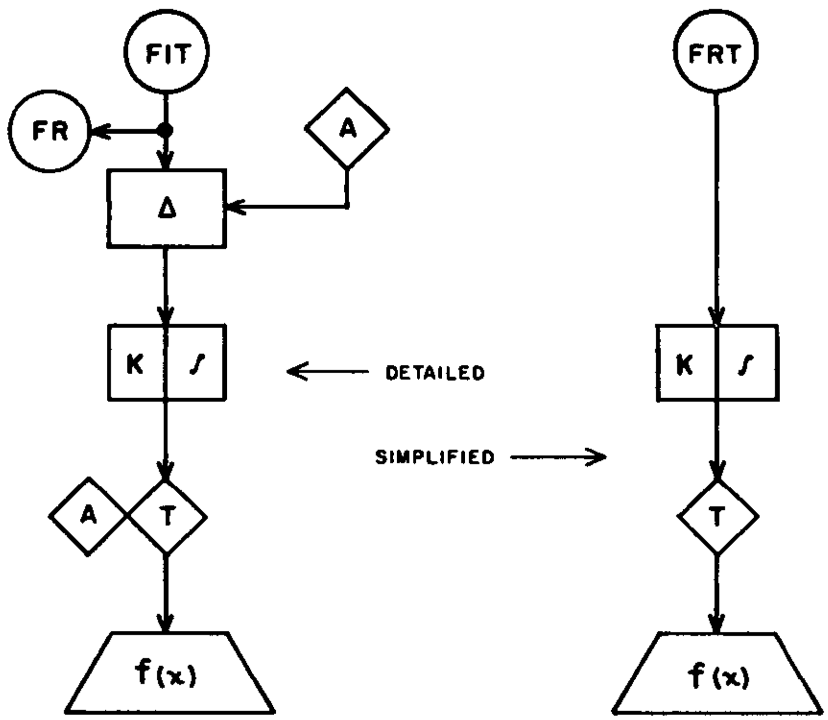
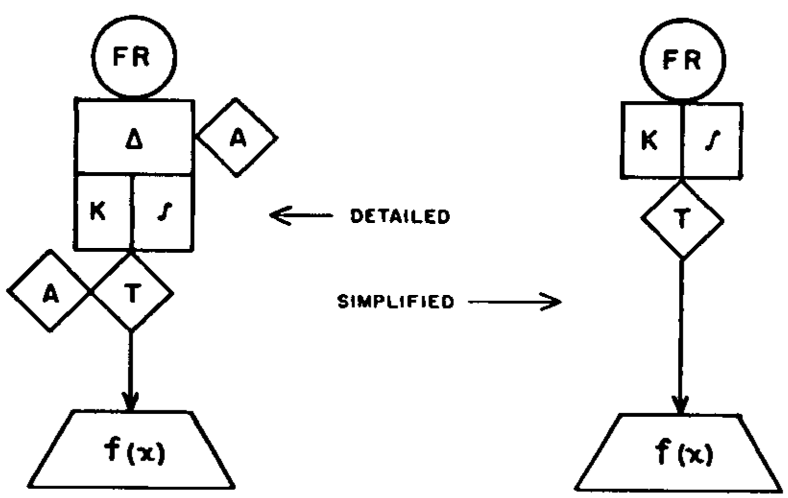
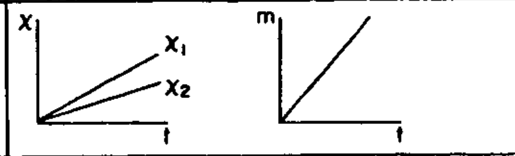
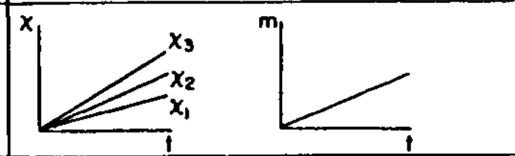
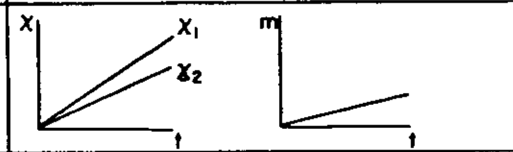
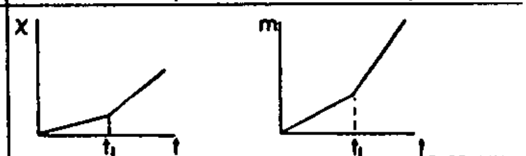
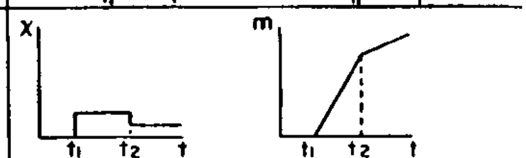
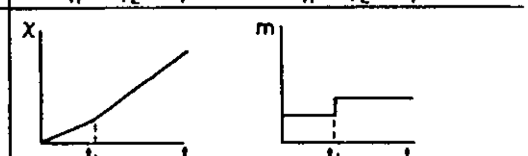
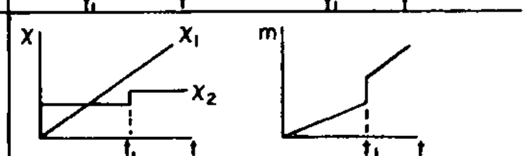
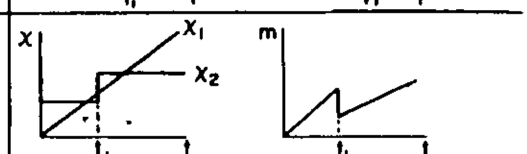
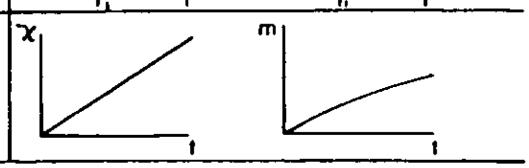


Figure 6B—Equipment Oriented Format



Appendices

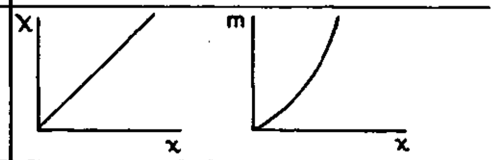
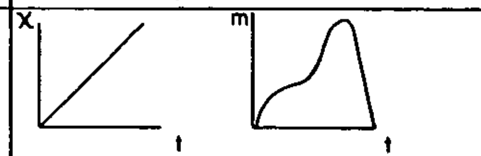
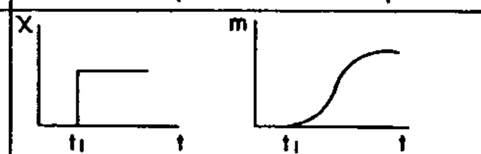
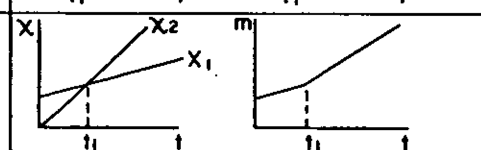
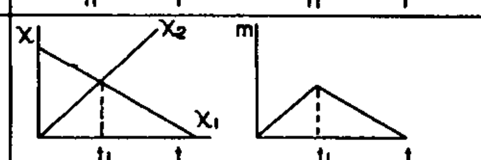
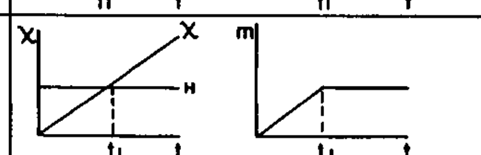
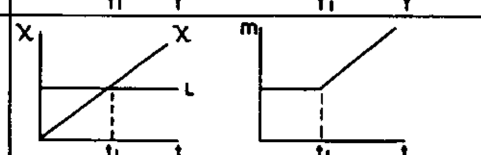
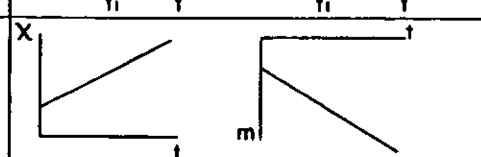
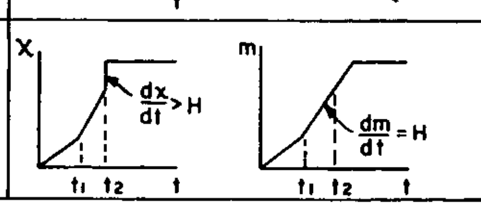
Appendix A.

NO	FUNCTION	SYMBOL	MATH EQUATION *	GRAPHIC REPRESENTATION *
1	SUMMING	Σ	$m = X_1 + X_2 + \dots\dots + X_n$	
2	AVERAGING	Σ/n	$m = \frac{X_1 + X_2 + \dots + X_n}{n}$	
3	DIFFERENCE	Δ	$m = X_1 - X_2$	
4	PROPORTIONAL	K OR P	$m = Kx$	
5	INTEGRAL	$\int$ OR I	$m = \frac{1}{T_I} \int x\,dt$	
6	DERIVATIVE	d/dt OR D	$m = T_D \frac{dX}{dt}$	
7	MULTIPLYING	X	$m = X_1 X_2$	
8	DIVIDING	$\div$	$m = \frac{X_1}{X_2}$	
9	ROOT EXTRACTION	$\sqrt{\ }$	$m = \sqrt{X}$	

* Refer to Appendix A.1 for Notations.

FUNCTION	DEFINITION
SUMMING	The output equals the algebraic sum of the inputs.
AVERAGING	The output equals the algebraic sum of the inputs divided by the number of inputs.
DIFFERENCE	The output equals the algebraic difference between the two inputs.
PROPORTIONAL	The output is directly proportional to the input.
INTEGRAL	The output varies in accordance with both magnitude and duration of the input. The output is proportional to the time integral of the input.
DERIVATIVE	The output is proportional to the rate of change (derivative) of the input.
MULTIPLYING	The output is proportional to the product of the two inputs.
DIVIDING	The output is proportional to the quotient of the two inputs.
ROOT EXTRACTION	The output equals the root (i.e. square root, fourth root, 3/2 root, etc.) of the input.

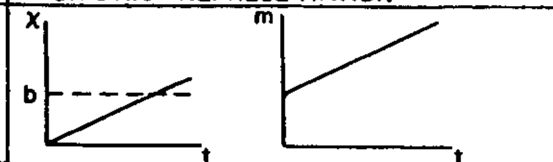
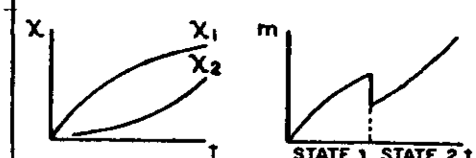
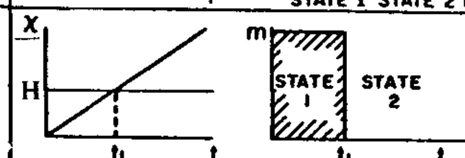
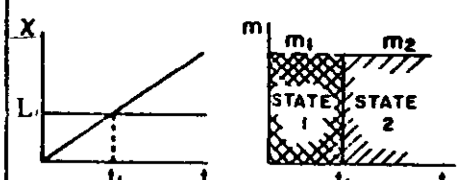
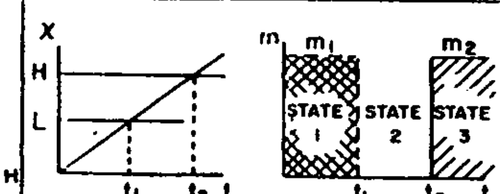
Appendix A. (continued)

NO	FUNCTION	SYMBOL	MATH EQUATION *	GRAPHIC REPRESENTATION *
10	EXPONENTIAL	x^n	$m = x^n$	
11	NONLINEAR FUNCTION	$f(X)$	$m = f(X)$	
12	TIME FUNCTION	$f(t)$	$m = X f(t)$ $m = f(t)$	
13	HIGH SELECTING	$>$	$m = \begin{cases} x_1 \text{ FOR } x_1 \geq x_2 \\ x_2 \text{ FOR } x_1 \leq x_2 \end{cases}$	
14	LOW SELECTING	$<$	$m = \begin{cases} x_1 \text{ FOR } x_1 \leq x_2 \\ x_2 \text{ FOR } x_1 \geq x_2 \end{cases}$	
15	HIGH LIMITING	$\not>$	$m = \begin{cases} x \text{ FOR } x \leq H \\ H \text{ FOR } x \geq H \end{cases}$	
16	LOW LIMITING	$\not<$	$m = \begin{cases} x \text{ FOR } x \geq L \\ L \text{ FOR } x \leq L \end{cases}$	
17	REVERSE PROPORTIONAL	−K OR −P	$m = -Kx$	
18	VELOCITY LIMITER	$V\not>$	$\frac{dm}{dt} = \frac{dx}{dt} \begin{cases} \frac{dx}{dt} \leq H \text{ AND} \\ m = x \end{cases}$ $\frac{dm}{dt} = H \begin{cases} \frac{dx}{dt} \geq H \text{ OR} \\ m \neq x \end{cases}$	

* Refer to Appendix A.1 for Notations.

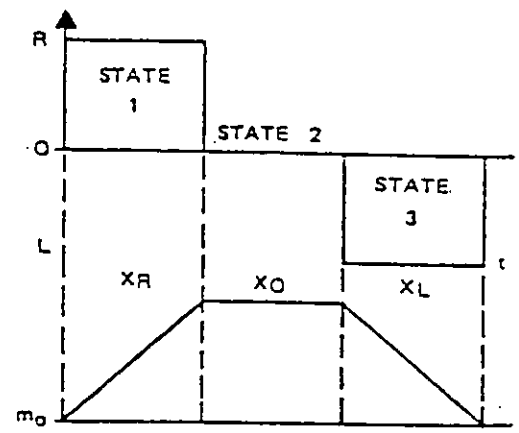
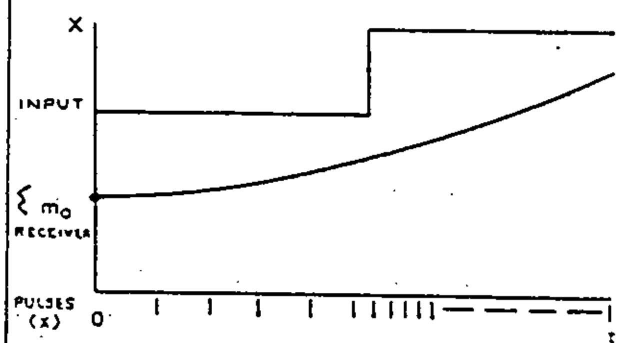
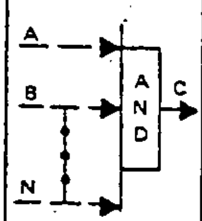
FUNCTION	DEFINITION
EXPONENTIAL	The output the input raised to a power (i.e. second, third, fourth, etc.).
NONLINEAR FUNCTION	The output equals some nonlinear function of the input.
TIME FUNCTION	The output equals the input times some function of time or equals some function of time alone.
HIGH SELECTING	The output is equal to that input which is the greatest of the inputs
LOW SELECTING	The output is equal to that input which is the least of the inputs.
HIGH LIMITING	The output equals the input or the high limit value whichever is lower.
LOW LIMITING	The output equals the input or the low limit value whichever is higher.
REVERSE PROPORTIONAL	The output is inversely proportional to the input.
VELOCITY LIMITER	The output equals the input as long as the rate of change of the input does not exceed a limit value. The output will change at the rate established by this limit until the output again equals the input.

Appendix A. (continued)

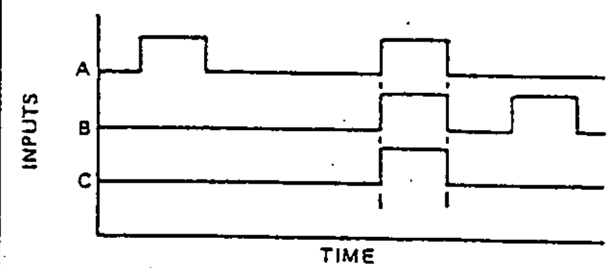
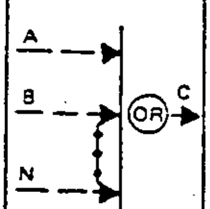
NO	FUNCTION	SYMBOL	MATH EQUATION *	GRAPHIC REPRESENTATION *
19	BIAS	+, −, OR ±	$m = x \pm b$	
20	VARIABLE SIGNAL GENERATOR	A	$m = A$	DOES NOT APPLY
21	LOGICAL SIGNAL GENERATOR	B	$m = B$	DOES NOT APPLY
22	TRANSFER	T	$m = \begin{cases} X_1 \text{ FOR STATE 1} \\ X_2 \text{ FOR STATE 2} \end{cases}$	
23	TWO STATE SIGNAL MONITOR	H/	STATE 1 (FIRST OUTPUT m_1 ENERGIZED OR ALARM STATE) $X > H$	
		L/	STATE 2 (SECOND OUTPUT m_2 ENERGIZED OR ALARM STATE) $X < L$	
24	THREE STATE SIGNAL MONITOR	H/L	STATE 1 (FIRST OUTPUT m_1 ENERGIZED OR ALARM STATE) $X < L$; STATE 2 (BOTH OUTPUTS INACTIVE OR DE-ENERGIZED) $L \leq X \leq H$; STATE 3 (SECOND OUTPUT m_2 ENERGIZED OR ALARM STATE) $X > H$	

* Refer to Appendix A.1 for Notations.

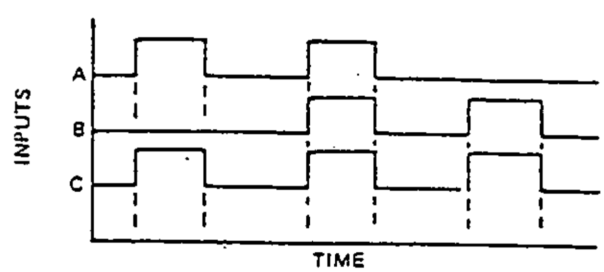
FUNCTION	DEFINITION
BIAS	The output equals the input plus (or minus) some arbitrary value (bias).
VARIABLE SIGNAL GENERATOR	The output is an analog signal developed within the generator.
LOGICAL SIGNAL GENERATOR	The output is an on-off signal developed within the generator.
TRANSFER	The output equals the input which has been selected by transfer. The state of the transfer is established by external means. The output is either on or off.
TWO STATE SIGNAL MONITOR THREE STATE SIGNAL MONITOR	The output has discrete states which are dependent on the value of the input. When the input exceeds (or becomes less than) an arbitrary limit value, the output changes state. Each of these arbitrary limit values may have deadband.

<table>
<tr><th>No.</th><th>FUNCTION</th><th>SYMBOL</th><th>MATH EQUATION</th><th>GRAPHIC REPRESENTATION</th></tr>
<tr><td>25</td><td>THREE STATE SIGNAL GENERATOR</td><td></td><td>STATE 1 = X_R
STATE 2 = X_O
STATE 3 = X_L</td><td>
</td></tr>
<tr><td>26</td><td>INTEGRATE OR TOTALIZE</td><td>Q</td><td>$M = m_o + \int_o^t x$
$\Sigma m_o^t = \int x dt$</td><td>
</td></tr>
<tr><td>27</td><td>LOGICAL AND</td><td>
</td><td>

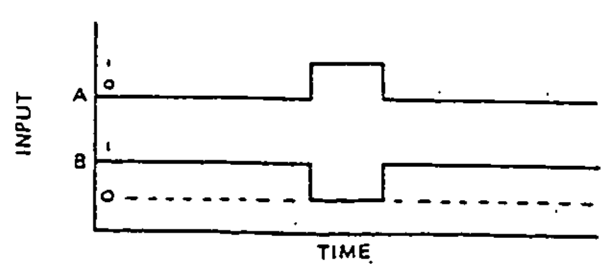
A	B	C
1	0	0
0	1	0
1	1	1
0	0	0

</td><td>
</td></tr>
<tr><td>28</td><td>LOGICAL OR</td><td>
</td><td>

A	B	C
1	0	1
0	1	1
1	1	1
0	0	0

</td><td>
</td></tr>
<tr><td>29</td><td>LOGICAL NOT</td><td>
</td><td>

A	B
1	0
0	1

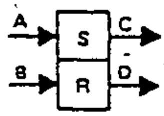
</td><td>
</td></tr>
</table>

FUNCTION	DEFINITION
THREE STATE SIGNAL GENERATOR	The output has discrete states which are dependent upon the state of the input. This device is normally associated with an integrator of some type.
INTEGRATE OR TOTALIZE	The output is a frequency which depends upon the value of the input. The output is normally associated with a counting device displaying the time integral of the input with some initial condition at T = 0
LOGICAL AND	The output is a Logic One only if all of the input signals are Logic Ones.
LOGICAL OR	The output is a Logic One if there is one or more Logic One inputs.
LOGICAL NOT	The output is a Logic One if the input is a Logic Zero. The output is a Logic Zero if the input is a Logic One.

No.	FUNCTION	SYMBOL	TRUTH TABLE	GRAPHIC PRESENTATION & DEFINITION

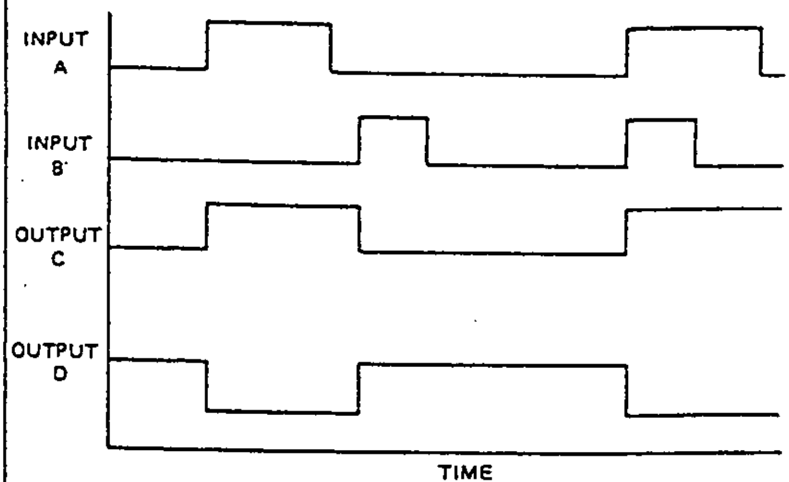
30 MEMORY

BASIC

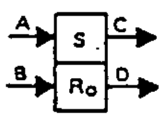


A	B	C	D
1	0	1	0
0	0	1	0
0	1	0	1
0	0	0	1
* 1	1	0	0

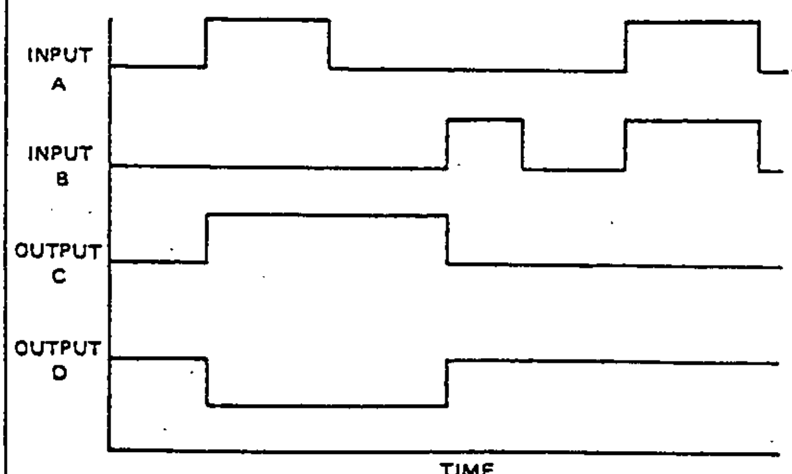
*OUTPUT CONDITION CHANGES FROM LAST STATE WHEN A & B SIMULTANEOUSLY TRUE



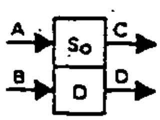
R_o DOMINANT



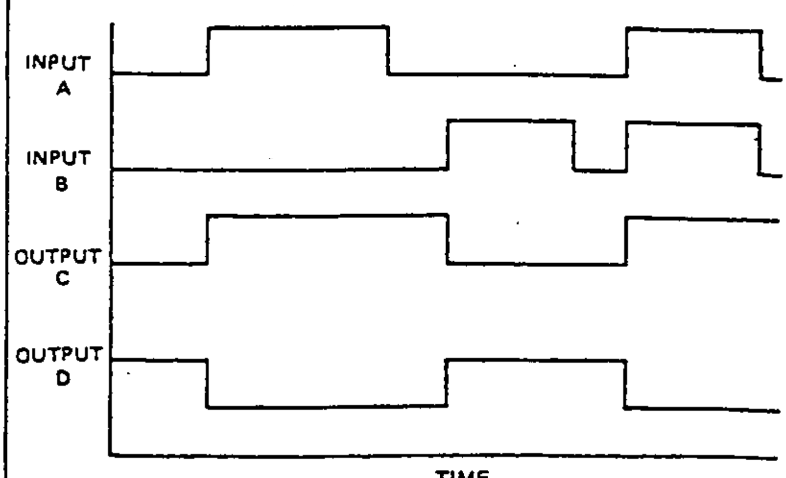
A	B	C	D
1	0	1	0
0	0	1	0
0	1	0	1
0	0	0	1
1	1	0	1



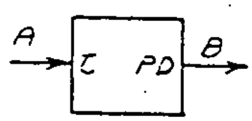
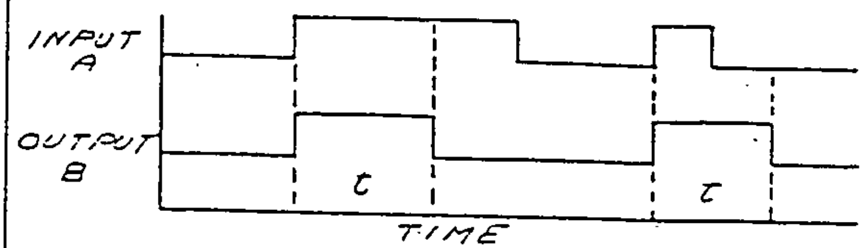
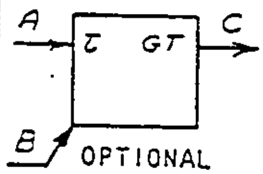
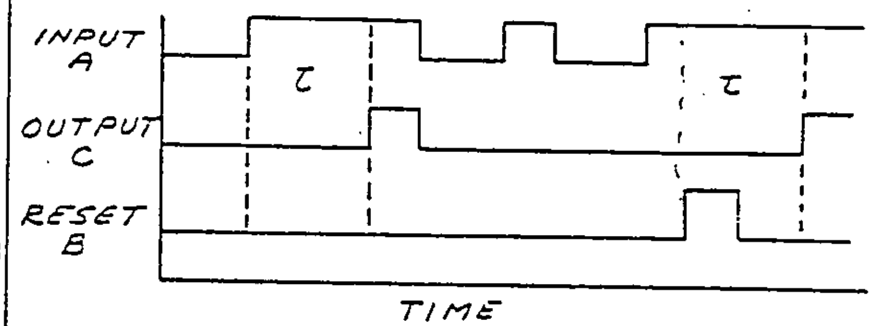
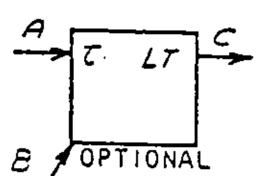
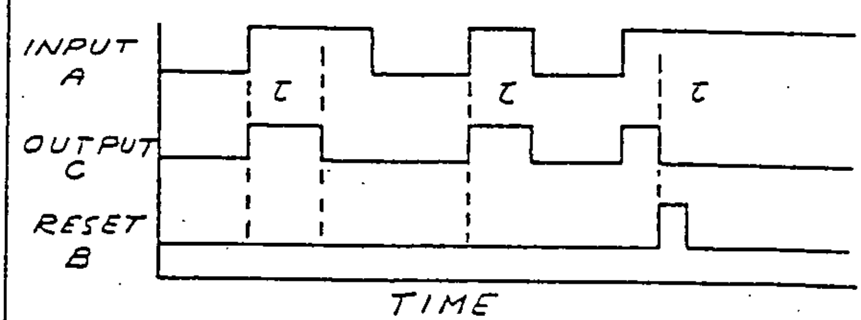
S_o DOMINANT



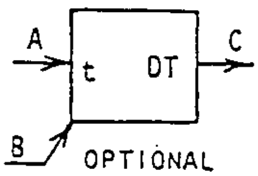
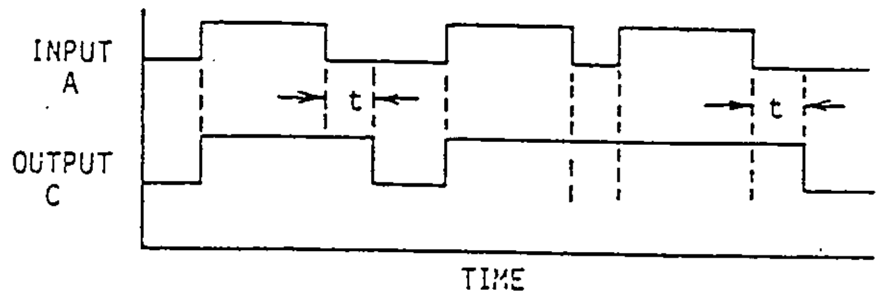
A	B	C	D
1	0	1	0
0	0	1	0
0	1	0	1
0	0	0	1
1	1	1	0



FUNCTION	DEFINITION
MEMORY	When only one input to a symbol is a logic one, the output of that square is Logic One. If this input is subsequently lost (Logic o) the output associated with that input is memorized (retained at Logic One). When the input to the other gate becomes Logic One, the outputs of both gates will change state. When designation (X_o) is in one of the gates and the inputs to both gates are Logic One, only the output from the gate with the override designation is Logic One.

NO	FUNCTION	SYMBOL	GRAPHIC REPRESENTATION & DEFINITION
31	PULSE DURATION	 PD=PULSE DURATION	
32	TIME DELAY	 OPTIONAL RESET INPUT GT=GREATER THAN TIME	
33	PULSE DURATION OF THE LESSER TIME	 OPTIONAL RESET INPUT LT=LESS THAN TIME	

FUNCTION	DEFINTION
PULSE DURATION	The output becomes a Logic One and remains a Logic One for a prescribed time duration t when triggered by the change in state of the input from Logic Zero to Logic One.
TIME DELAY	The output becomes a Logic One when the input is Logic One continuously from time t. The output remains Logic One until the input becomes Logic Zero or the optional reset input is Logic One, at which time the timer is reset and the Output becomes Logic Zero.
PULSE DURATION OF THE LESSER TIME	The output becomes Logic One when the input becomes Logic One. The output becomes Logic Zero when the input becomes Logic Zero, or when the input has been Logic One for t seconds, or when the optional reset input becomes Logic One.

NO	FUNCTION	SYMBOL	DEFINITION
34	TIME DELAY	 OPTIONAL RESET INPUT DT=DELAY TERMINATION OF INPUT	
35	INPUT/ OUTPUT CONVERTER	INPUT/OUTPUT SYMBOL/SYMBOL A/D I/P P/I	

FUNCTION	DEFINITION
TIME DELAY	The output becomes Logic One when the input becomes Logic One. The output becomes Logic 0 when the input becomes Logic 0 and does not become Logic One for time t.
INPUT/OUTPUT CONVERTER	The conversion of a signal from one type to another is designated by any two of the defined symbols separated by a / with the input signal at left and the output signal at right. A = ANALOG I = CURRENT D = DIGITAL O = ELECTROMAGNETIC OR SONIC E = VOLTAGE P = PNEUMATIC F = FREQUENCY R = RESISTANCE H = HYDRAULIC

Appendix A.1 Notations

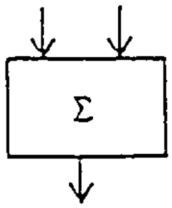
The variables used in the table are:

A	—An arbitrary analog signal
b	—Analog bias value
d dt	—Derivative with respect to time
H	—An arbitrary analog high limit value
t_i	—Integrating rate
L	—An arbitrary analog low limit value
m	—Analog output variable
n	—Number of analog inputs or value of exponent
T	—Time
T_D	—Derivative time
x	—Analog input variable
$x_1, x_2, x_3 \ldots x_n$	—Anlog input variable (1 to n in number)
b	—An arbitrary logical signal
Y	—Logical input variable
$Y_1, Y_2, Y_3 \ldots Y_m$	—Logical input variable (1 to m in number)
Z	—Logical output variable

Appendix B

1

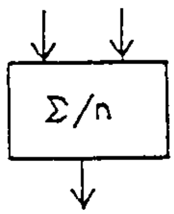
SUMMING TWO SIGNALS



MORE THAN TWO SIGNALS CAN BE SUMMED IF REQUIRED

2

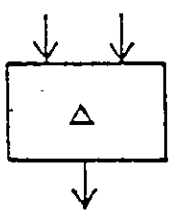
AVERAGING TWO SIGNALS



MORE THAN TWO SIGNALS CAN BE AVERAGED IF DESIRED.

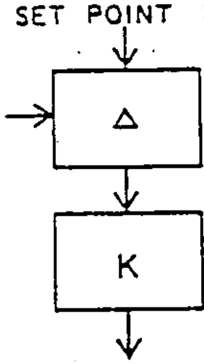
3

DIFFERENCE OF TWO SIGNALS

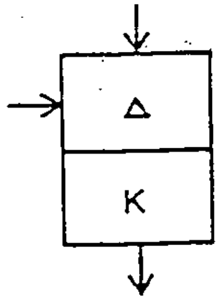


4

PROPORTIONAL CONTROL WITH SET POINT FROM EXTERNAL SOURCE

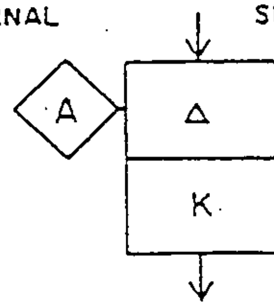


OR



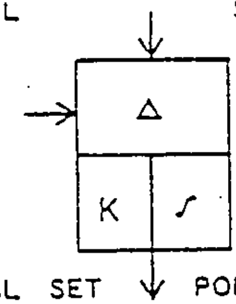
5

PROPORTIONAL CONTROL WITH INTERNAL SET POINT



6

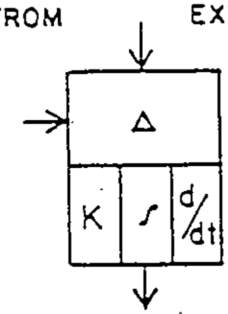
PROPORTIONAL PLUS INTEGRAL CONTROL WITH SET POINT FROM EXTERNAL SOURCE.



INTERNAL SET POINT TO BE DIAGRAMMED AS IN EXAMPLE 5

7

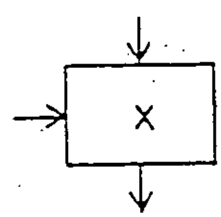
PROPORTIONAL PLUS INTEGRAL PLUS DERIVATIVE CONTROL WITH SET POINT FROM EXTERNAL SOURCE



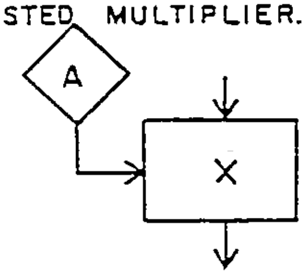
INTERNAL SET POINT TO BE DIAGRAMMED AS IN EXAMPLE 5

8

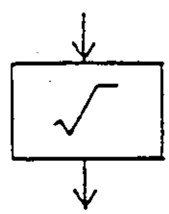
MULTIPLYING ONE SIGNAL BY ANOTHER.



9 MULTIPLYING ONE SIGNAL BY A MANUALLY ADJUSTED MULTIPLIER.

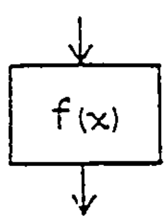


10 ROOT EXTRACTING

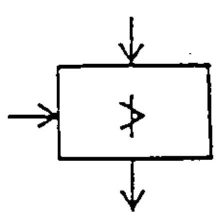


ROOT MAY BE ADDED FOR CLARITY SUCH AS $\sqrt[2]{\quad}$ $\sqrt[3]{\quad}$

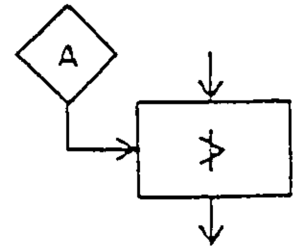
11 NON-LINEAR FUNCTION PERFORMED ON A SIGNAL



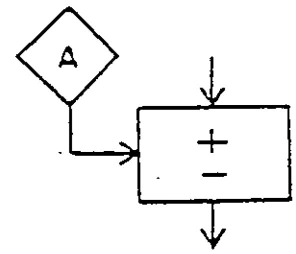
12 HIGH LIMITING OF ONE SIGNAL BY ANOTHER.



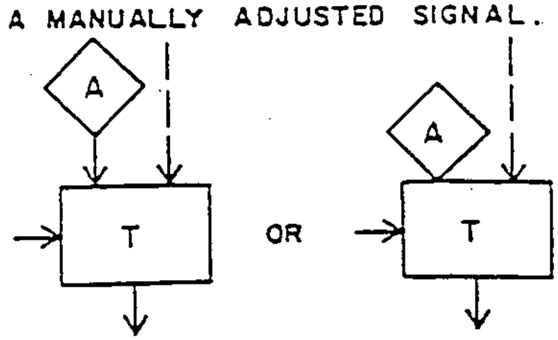
13 HIGH LIMITING OF A SIGNAL BY A MANUAL ADJUSTMENT



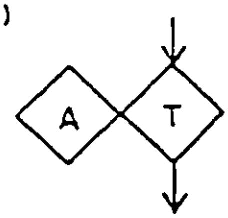
14 BIASING OF A SIGNAL BY A MANUAL ADJUSTMENT



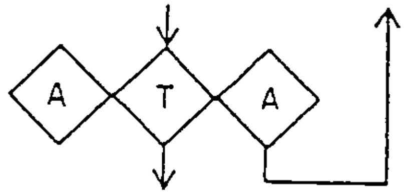
15 AUTOMATIC TRANSFER TO OR FROM A MANUALLY ADJUSTED SIGNAL.



16 MANUAL TRANSFER TO OR FROM A MANUALLY ADJUSTED SIGNAL. (MANUAL-AUTOMATIC CONTROL STATION)

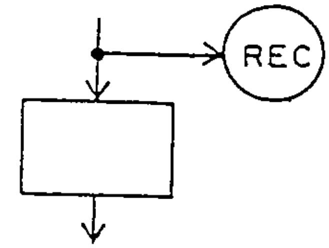


17 MANUAL TRANSFER TO OR FROM A MANUALLY ADJUSTED SIGNAL AND INCLUDING SET POINT.



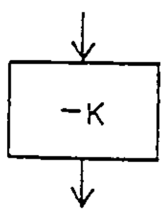
(MANUAL-AUTOMATIC CONTROL STATION WITH SET POINT)

21 READOUT FUNCTION (RECORDER, INDICATION)

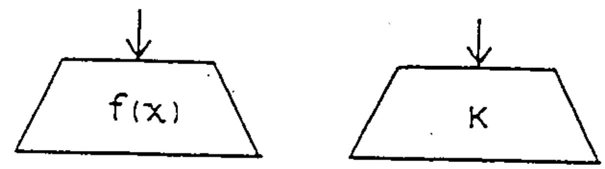


SEE ALSO ISA RP5.1

18 SIGNAL REVERSAL



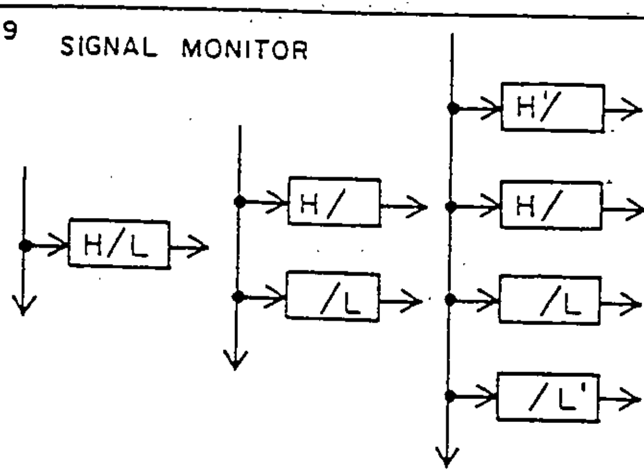
22 FINAL CONTROLLING FUNCTION (CONTROL VALVE OR DRIVE)



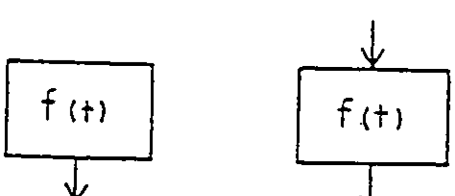
WITH CHARACTERIZATION

WITH GAIN ADJUSTMENT

19 SIGNAL MONITOR



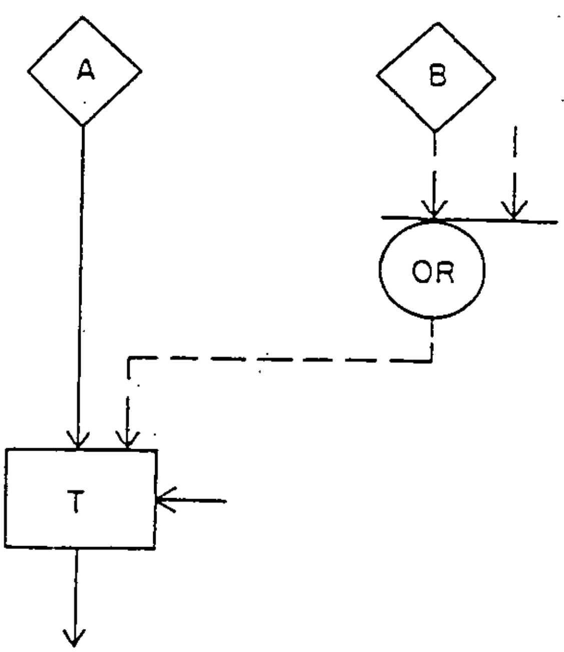
20 TIME FUNCTION



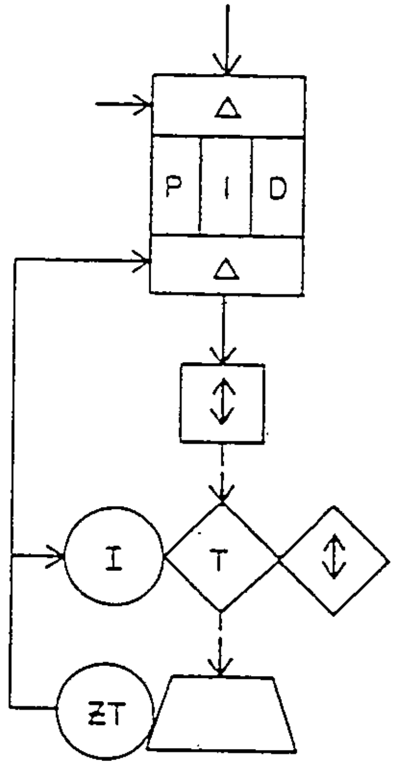
FUNCTION OF TIME ONLY. (PROGRAM CONTROLLER)

SIGNAL MODIFIED BY A FUNCTION OF TIME.

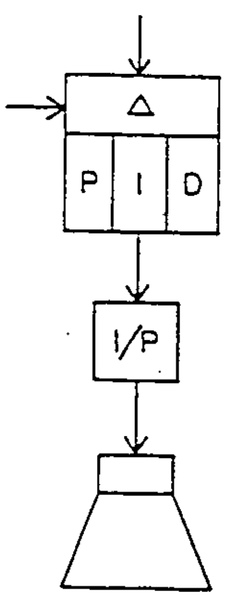
23 MANUAL OR AUTOMATIC TRANSFER TO OR FROM A MANUALLY ADJUSTED SIGNAL



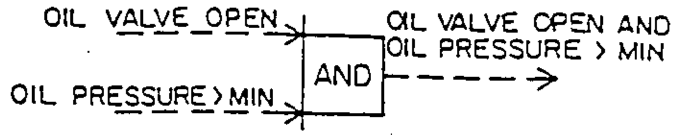
24 PROPORTIONAL PLUS INTEGRAL PLUS DERIVATIVE CONTROLLER WITH EXTERNAL SETPOINT AND WITH A POSITIONER FOR ELECTRIC DRIVE FINAL CONTROLLING FUNCTION



25 PROPORTIONAL PLUS INTEGRAL PLUS DERIVATIVE CONTROLLER WITH EXTERNAL SETPOINT AND WITH A POSITIONER FOR PNEUMATIC DRIVE FINAL CONTROLLING FUNCTION



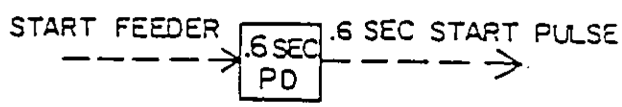
26 LOGICALLY ANDING TWO SIGNALS



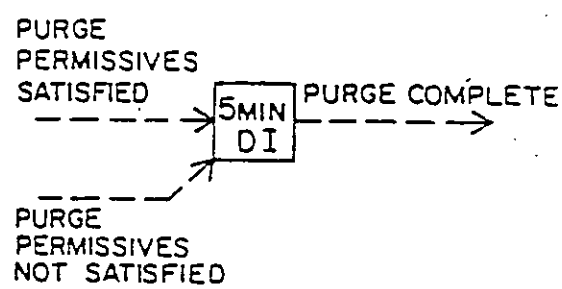
MORE THAN TWO SIGNALS MAY BE ANDED. LINE ANNOTATIONS STATE THE "TRUE" OR "ON" CONDITION

27 LOGICALLY INVERTING A SIGNAL (NOT)

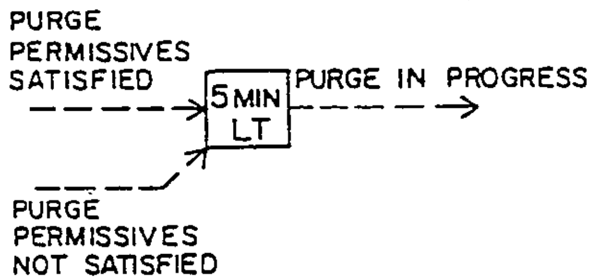
28. PULSE DURATION



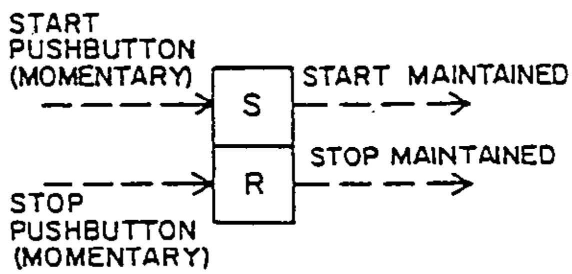
29 TIME DELAY (DI)



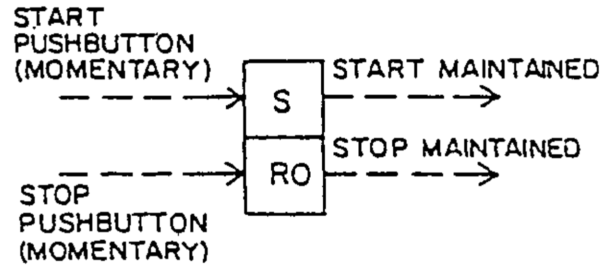
30 TIME DELAY (LT)



31 MEMORY WITHOUT OVERRIDE

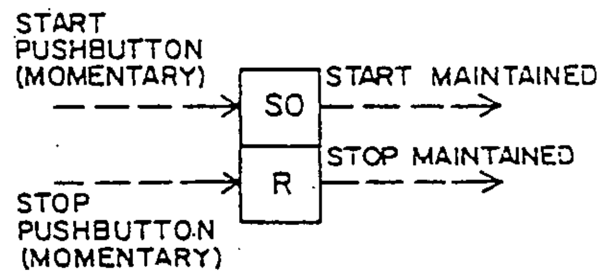


32 MEMORY WITH RESET OVERRIDE



IF BOTH THE START AND STOP PUSH-BUTTONS ARE DEPRESSED, ONLY THE RESET OUTPUT IS "TRUE" OR "ON."

33 MEMORY WITH SET OVERRIDE



IF BOTH THE START AND STOP PUSH-BUTTONS ARE DEPRESSED, ONLY THE SET OUTPUT IS "TRUE" OR "ON."