General Purpose Controller

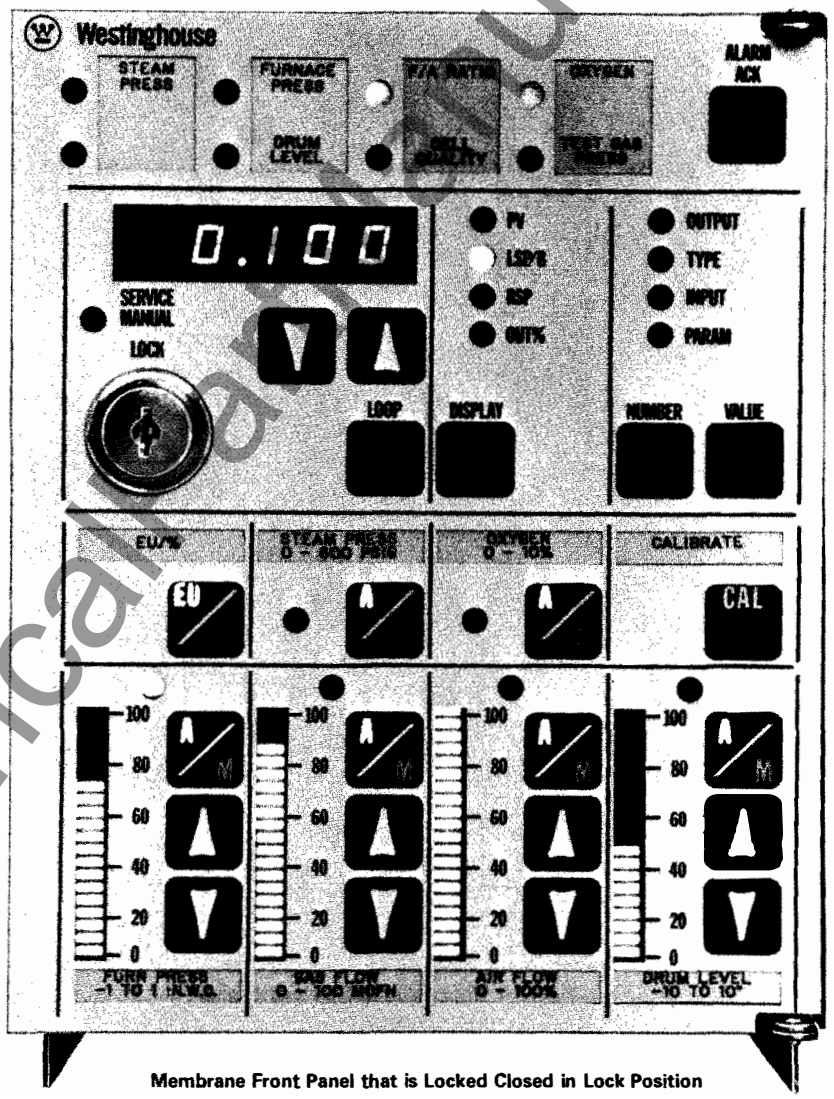
Microprocessor Based

The Westinghouse GPC 1500A Controller is a multi-loop or unit controller that can operate independently or within a Distributed Control Sytstem. Whether used in a Distributed Control System or independently, it is an autonomous controller. Control system configurations are stored in its memory. Each GPC 1500A can control complex systems consisting of as many as six loops with four controlled outputs. These controlled outputs are continuously tracked by its track and hold board, which insures safe process operation under abnormal controller malfunction.

Typical applications include entire boiler, soaking pit, reheat furnace, process heater and pipeline override control systems. Other applications include multi-probe averaging and sulfur emissions monitoring.

This microprocessor-based system is specifically designed to utilize a building block concept, which permits easy configuration of a wide range of complex control applications. A flexible set of blockware allows control systems to be designed to meet specific customer applications without computer programming knowledge. External hardware is not required to enter new configurations.

The GPC 1500A is designed with adequate memory and programmable capability to perform as a multi-loop controller, as well as an integral part of a Distributed Control System.



Membrane Front Panel that is Locked Closed in Lock Position

Features

- Blockware designed with 55 different control algorithms
- Scan rate of 4 times/second
- Six Automatic/Manual stations
- Four controlled outputs backed up with track and hold logic
- Four A/M stations with separate increase decrease pushbuttons and output bargraph indicators
- Four trend outputs
- First out eight alarm annunciator
- Built in diagnostics with error display
- 4½ digit display for loop and configuration data and error message display
- Process variables and set-points displayed in either percent or engineering units
- Configurations and tuning directly from front panel
- Customized labels for loop and alarm identification
- Optional cassette tape unit available for configuration loading
- Key-lock protection of configuration and tuning parameters
- Special function blocks allow automatic recalibration of all Westinghouse probe-type O_2 and SO_x Analyzer packages
- Available with Canadian Standards Association (CSA) approval.

Membrane Front Panel

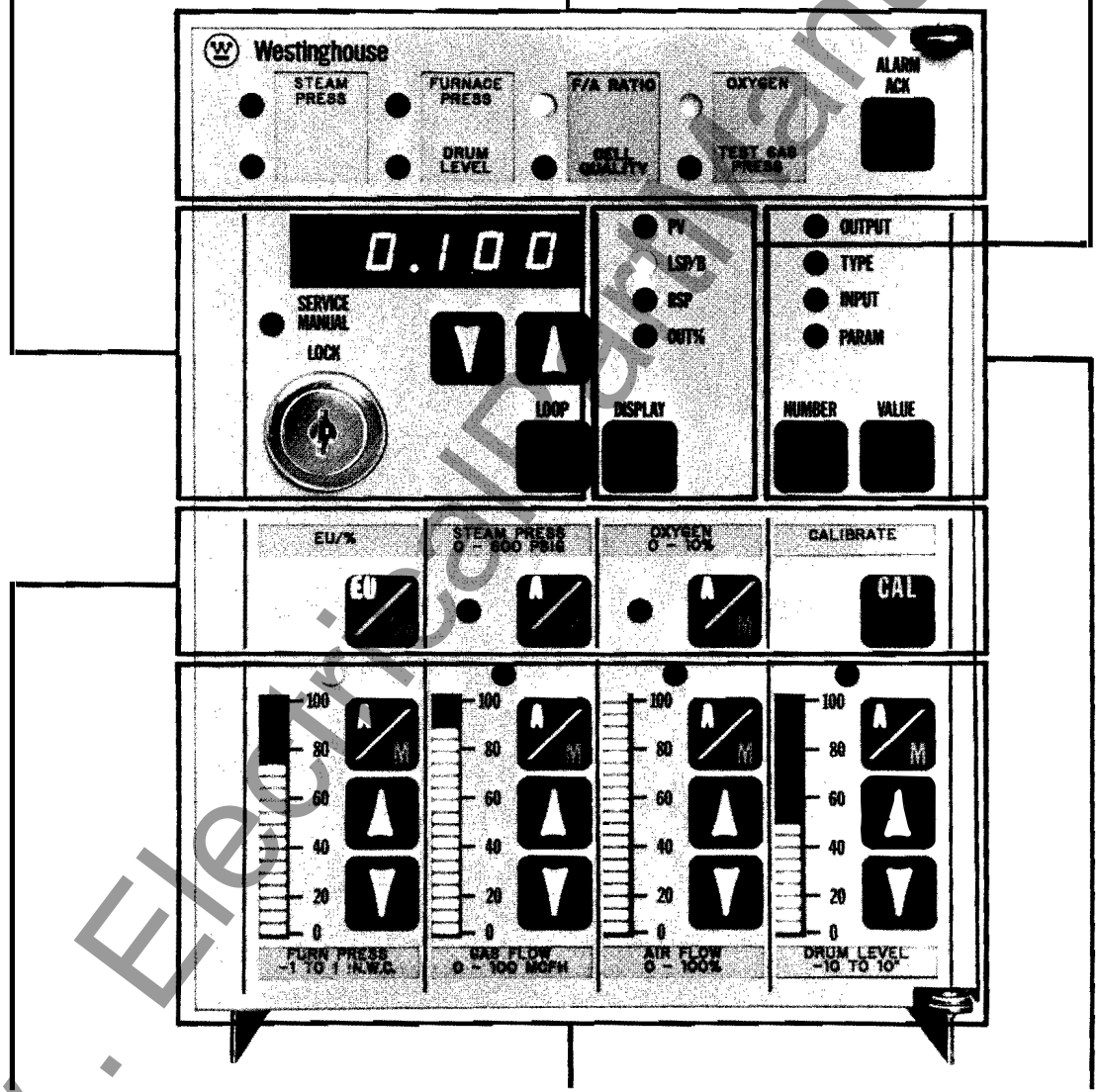
The membrane front panel makes the GPC 1500A suited for harsh industrial environments since it is sealed and lockable, preventing damage from dirt and grime buildup and prevents unauthorized entry to the electronic enclosure.

The panel utilizes highly reliable membrane switch technology. This technology establishes more reliable electronics due to single printed circuit board construction and elimination of mechanical switches. Other benefits include highly visible bargraph indications for loop outputs and lower maintenance/calibration costs due to the elimination of incandescent lamps and mechanical pushbuttons. In addition, the membrane switches are easily activated with an operating force of six to eight ounces per square inch.

The INCR-DECR pushbuttons under the 4½ digit LED (light emitting diode) display will change the displayed variable. The key switch prevents unauthorized personnel from changing configuration and tuning data. Examples of variables which may be changed are set points and loop outputs in manual. The loop pushbutton cycles through the loop LEDs to identify the loop being displayed. The SERVICE MANUAL LED is lit when the analog tracking circuitry is controlling the outputs.

An eight alarm first out annunciator panel with customized legends and an alarm acknowledge pushbutton.

The DISPLAY pushbutton is used to select the process variable, local setpoint or bias, remote set point, or percent output of the loop identified by the LOOP LEDs.



The four auxiliary backlift pushbuttons may be configured to select percent or engineering units, perform automatic oxygen calibration, or serve as remote/local pushbuttons. The two pushbuttons with adjacent loop LEDs may also be configured to be Auto/Manual pushbuttons, and serve as auxiliary loops internal to a control system.

The four controlled outputs are indicated on separate output bargraph indicators. Each primary loop has its own backlit Auto/Manual pushbutton and separate increase-decrease pushbuttons. The loop LEDs above the meters are used by the LOOP pushbutton to select the loop being displayed on the digital readout. The customized loop legends are used to specify the process variable and its engineering units.

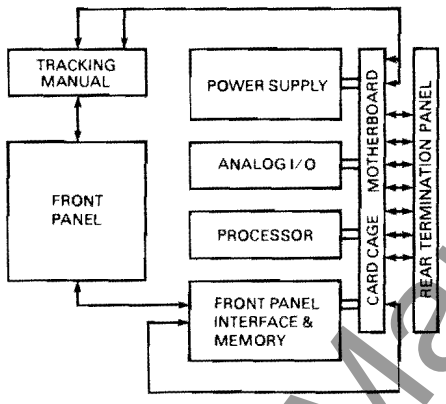
The NUMBER AND VALUE pushbuttons identify configuration information and are used along with the shared INCR-DECR pushbuttons to enter configuration and tuning data.

The Model GPC 1500A can accept 9 contact inputs, 7 analog inputs, 8 analog outputs and 7 relay or TTL outputs. The unit can handle either current or voltage I/O. The self-contained switching power supply operates on line voltage. An optional 24 VDC external auxiliary power connection will maintain controlled outputs (outputs 1-4) during servicing or in the event of 115 volt power loss.

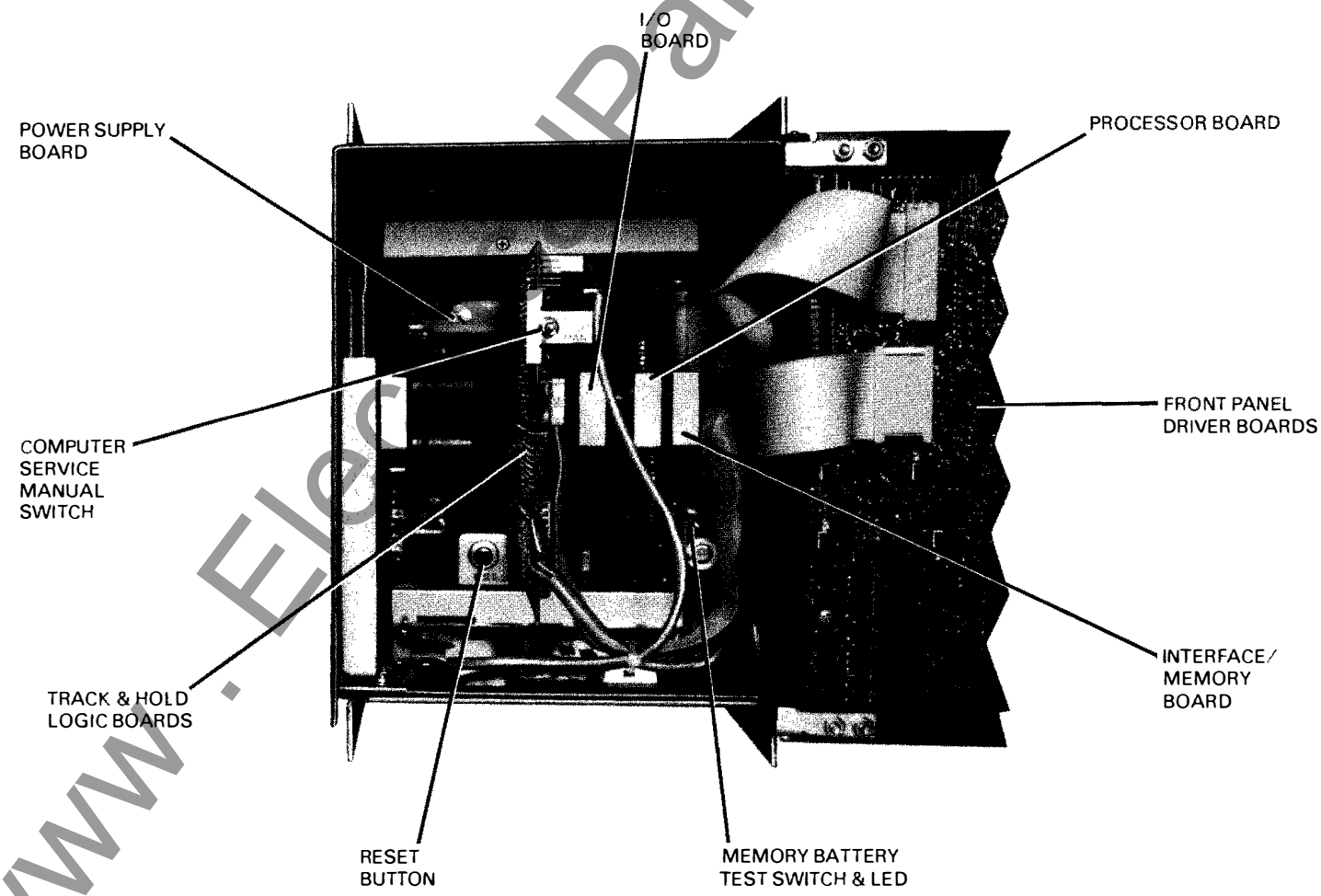
Six major electronic sub-assemblies make up the Model GPC 1500A. They are the power supply card, the analog I/O card, the processor card, the interface card, the track and hold service manual board, and the front panel assembly.

The track-and-hold logic designed into the Model GPC 1500A eliminates the need for separate analog backup stations. During servicing, the unit can be switched to the tracking circuitry by means of the Computer Mode Request-Neutral-Service manual (CMR-NEUTRAL-MANUAL) switch located on the track and hold circuit board. The operator retains manual control, with indication of the outputs through the increase-decrease pushbuttons adjacent to the output bargraph indicators. Service manual STATUS is indicated by an LED on the front panel.

Major Electronic Subassemblies



The control configuration is stored in battery backed up CMOS memory on the interface card. The battery is trickle charged during normal operation, and will protect the contents of CMOS memory for approximately 3 months in case of loss of power. A switch and an LED adjacent to the battery can be used to check the condition of the battery. The actual configuration is entered into CMOS memory from the front panel but can also be entered via a cassette tape or a computer station which may be part of the control system. Configuration and tuning are under key-lock protection.

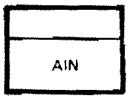


Blockware Configuration

BLOCKWARE refers to the set of pre-programmed control algorithms in the Model GPC 1500A. Control Systems are implemented by interconnecting the control algorithms, or control blocks, to perform the desired control functions. Control blocks do not reside in pre-defined slots. Blocks are evaluated sequentially by block number. Within certain memory limitations which will be flagged as configuration errors, a control system may use any block in the BLOCKWARE library any number of times. Configuration information is stored in battery backed up CMOS memory.

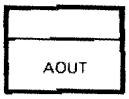
Process and Operator Interface

ANALOG INPUT



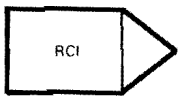
The AIN block filters the input signal from the rear panel and converts it to a -10% to 110% analog variable.

ANALOG OUTPUT



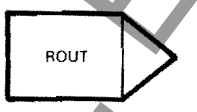
The AOUT block transfers its' input variable to an output port.

REMOTE CONTACT INPUT



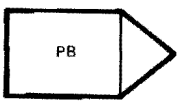
The RCI block transfers a contact input status to the control system.

RELAY OUTPUT



The ROUT block energizes one of the output relays.

PUSHBUTTON

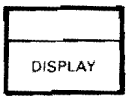


The PB block develops a logic signal from one of the eight backlit pushbuttons.

ALARM

The ALARM block interfaces the alarm status of 8 logic inputs to the front panel LEDs.

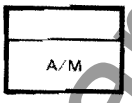
DIGITAL DISPLAY INTERFACE



The DISPLAY block identifies the process variable, local set point or bias, remote set point, and output of one of the six loops in the controller. This information can then be accessed by the loop and display pushbuttons on the front panel.

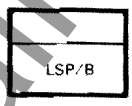
Control Functions

AUTO/MANUAL STATION



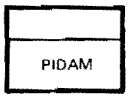
The A/M block generates the internal controlled output for one of the six loops in the unit.

LOCAL SET POINT OR BIAS



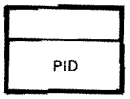
The LSP/B block generates the local set point or bias to a loop controller.

PIDAM CONTROLLER



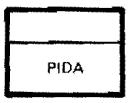
The PIDAM controller combines the function of PID controller and A/M station in one block.

PID CONTROLLER



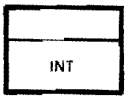
The PID controller block may be used with other control blocks to implement feed-forward control, ratio control, cascade control, or standard 3-mode control.

ADAPTIVE CONTROLLER



The PIDA controller can be configured to perform variable gain and override control.

INTEGRAL

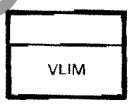


The INT block computes the integral of its' input.

LEAD-LAG

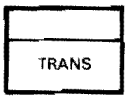
The LEDLAG block provides dynamic compensation to an analog signal.

VELOCITY LIMIT



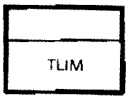
The VLIM block limits the rate of change of its output.

TRANSFER



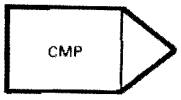
The transfer block transfers control between two analog signals.

VELOCITY LIMITED TRANSFER



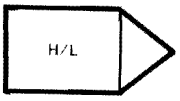
The TLIM block provides bumpless transfer between two analog inputs at independently adjustable rates.

COMPARATOR



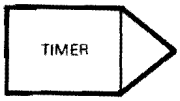
The CMP block compares two analog inputs to develop the digital output.

HIGH/LOW STATUS



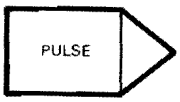
The output of the H/L block is a logical value which represents the alarm status of the analog input variable.

TIMER



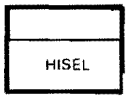
The TIMER block generates a pulse at an adjustable interval.

PULSE

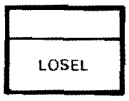


The PULSE block generates a variable width pulse.

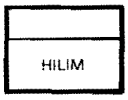
HIGH SELECT



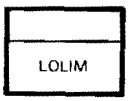
LOW SELECT



HIGH LIMIT

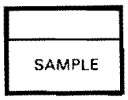


LOW LIMIT

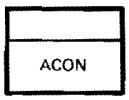


Arithmetic Functions

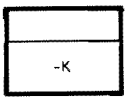
SAMPLE AND HOLD



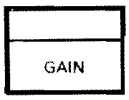
ANALOG CONSTANT



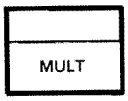
ANALOG INVERTER



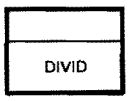
GAIN



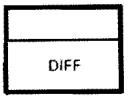
MULTIPLY



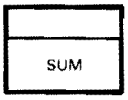
DIVIDE



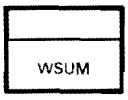
DIFFERENCE



SUMMATION

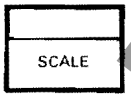


WEIGHTED SUMMER

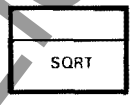


The WSUM block computes the weighted SUM of two analog inputs.

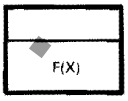
SCALE



SQUARE ROOT

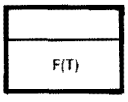


FUNCTION GENERATOR



F(X) block defines a four line segment function generator.

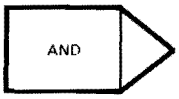
TIME FUNCTION



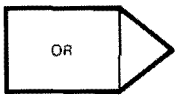
The F(T) block can generate a four break point time ramp.

Digital Logic Functions

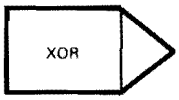
AND



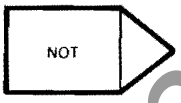
OR



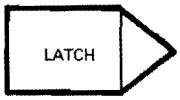
EXCLUSIVE OR



NOT



LATCH



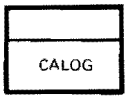
LOGIC CONSTANT

Automatic Calibration

CALIBRATE PUSHBUTTON

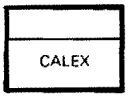
The CALPB block is a special purpose block to interface a back lit pushbutton to the auto-calibration logic.

CALOG



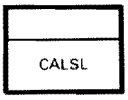
The output of CALOG block is the slope of the logarithmic signal from an oxygen probe.

CALEX



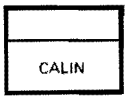
The CALEX block linearizes the logarithmic signal from an oxygen probe. During auto-calibration the output is held constant.

CALSL



The output of the CALSL block is the slope of any oxygen probe with a linear output.

CALIN



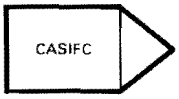
The CALIN block scales the input signal from a linear oxgyen probe. During auto calibration the output is held constant.

Miscellaneous Functions

TREND

The output of the TREND block is equal to the output of the block number referenced.

CASSETTE INTERFACE

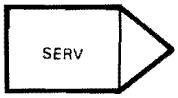


The CASIFC block is used to transfer configuration data from the Model 1500 GPC to the optional ADPI cassette unit.

UNACKNOWLEDGED ALARM

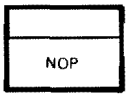
The output of the UNACK block is true if there are any acknowledged alarms pending.

SERVICE MANUAL



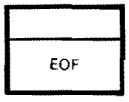
The SERV block output is true if the unit is in the service manual mode.

NO OPERATION



The NOP block reserves space for future expansion of a control system.

ENDOF FILE



The EOF block is the last block in any control implementation and signals the end of the configuration data.

The GPC 1500A has extensive built-in diagnostics to identify hardware malfunctions and configuration errors.

Specifications ①

Mechanical

Enclosure:
Type—Panel Mounting, ¾" thickness max.

Approx. Case Size	Height—7½" (19.1 cm) Depth—6⅜" (16.2 cm)
Panel Cutout	7⁹⁄₁₆"x6⁷⁄₁₆" (19.2x16.1 cm)
Access:	All circuit cards are accessible behind hinged front panel
Weight	25 lbs. (11.4 Kg)

Environmental

Temperature	32-130°F (0-55°C)
Relative Humidity	0-90% non-condensing

Electrical

Power Consumption	30VA
Power	115 VAC ± 10%, 50-60 Hz, 1 amp
AC Line Voltage Interrupt	two cycles without loss of control
Scanning Rate	4 times/second
Analog Signal Inputs	1-5VDC, 0-5VDC 2-10VDC, 0-10VDC 4-20mA, 0-20mA
Impedance	Voltage 900K ohms Current 250 ohms
Accuracy	0.1%
Maximum	Seven
Contact Inputs	Type, dry Rating 24VDC 2.5mA
Maximum	Nine
Analog Signal Outputs	0-10VDC 4-20mA, 20-4mA
Impedance	Voltage < 10 ohms current, 4-20mA into 0 to 900 ohms, current terminates at signal common.
Maximum	Eight
Contact or TTL Outputs	2 amps at 28VDC; 0.5 amps at 120VAC (for contact only)
Maximum	Seven (6 programmable, 7th indicates unit failure).
Contact Style	Two form C relays Four forms A or B relays
Alarm Status	Eight LED Indicators front panel mounted flashing upon alarm, steady state upon acknowledge.
Analog Backup	Separately powered track and hold board automatically provides manual control in the event of power failure or microprocessor failure for 4 primary outputs.
Manual Output Battery Backup	Zero Drift
RFI/EMI Rejection	To 2000 volts with a rise time of 5ns.

Memory

Battery Backup	≈ 3 months, provides battery backup to CMOS memory.

Cassette Interface

An optional cassette unit is available to load and store configurations.

Labels

8 alarm legends	2 lines each 8 letters per line max.
8 loop labels	2 lines each 14 letters per line max.
4 pushbutton labels	4 characters max.

How to Order

Select the basic General Purpose Controller with desired options and accessories.

Model 1500A

General Purpose Digital Controller

Number of V/I Converters:

Qty.	
0 None	0
1 Voltage to Current Converter	1
2 Voltage to Current Converter	2
3 Voltage to Current Converter	3
4 Voltage to Current Converter	4

Cover Options:

Qty.	
1 Rear Terminal Cover	1
1 Drip Cover and Rear Terminal Cover	2

No Factory Configuration	1
*Factory Configured	2

Options:

None	1
Cassette	2
RS232 Termination Board	3
RS422 Termination Board	4

General Purpose	1
CSA Approved	3

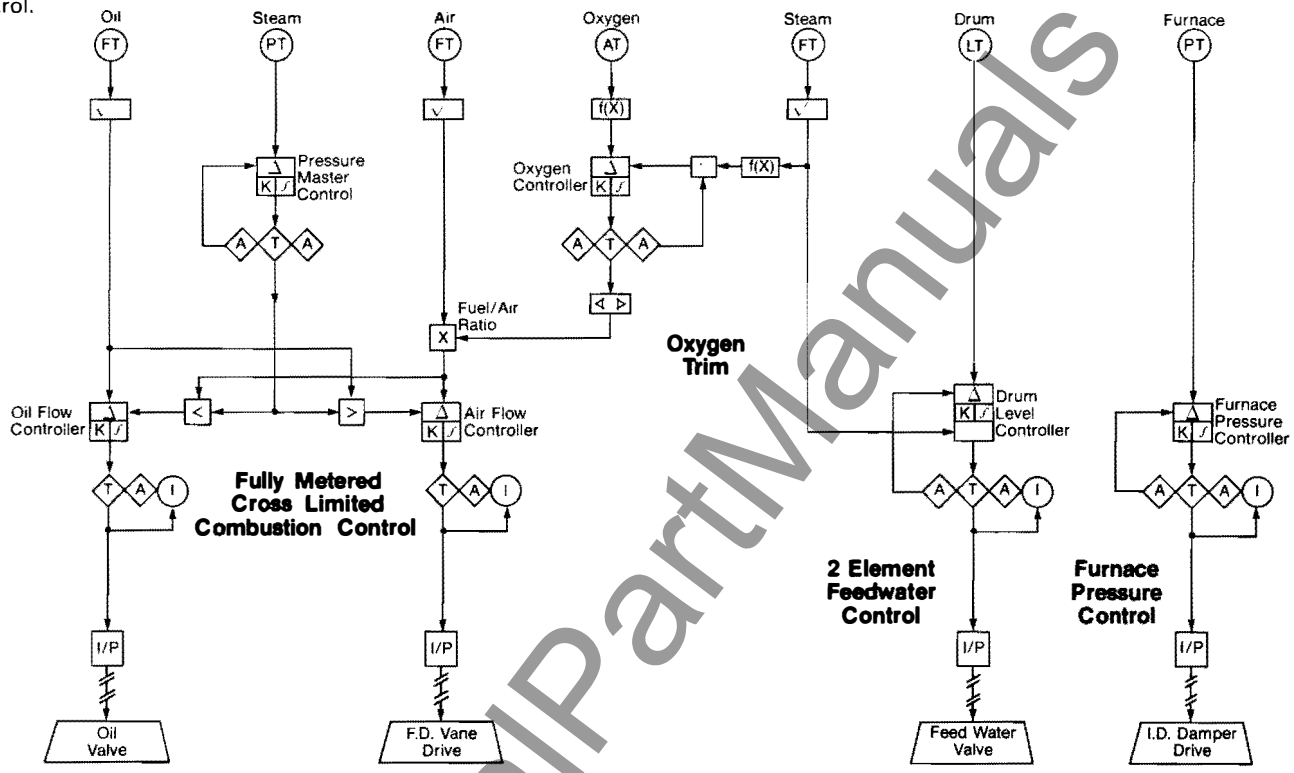
Example:
Model 1500A—11111
This specifies a controller for enclosed panel mounting, with one 4-20 mA DC Output Module.

Battery back-up for manual output, see DB 100-153.

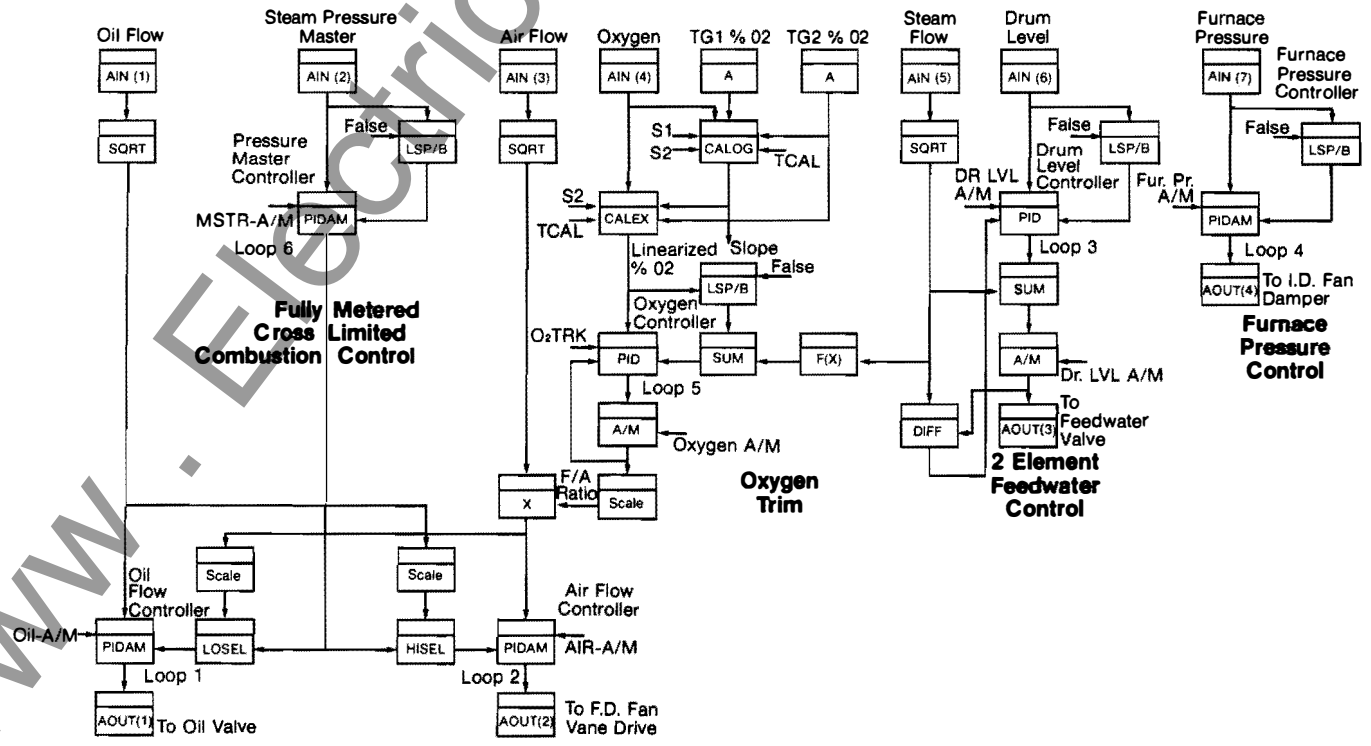
Cable assembly for battery back-up required . . . order P/N 3534B88. See PL 100-151.

① Equipment ordered utilizing this DB as reference will be supplied to the USA Standard design. Customers needing the EEC Standard design should request the EEC Standard DB and utilize its ordering data.

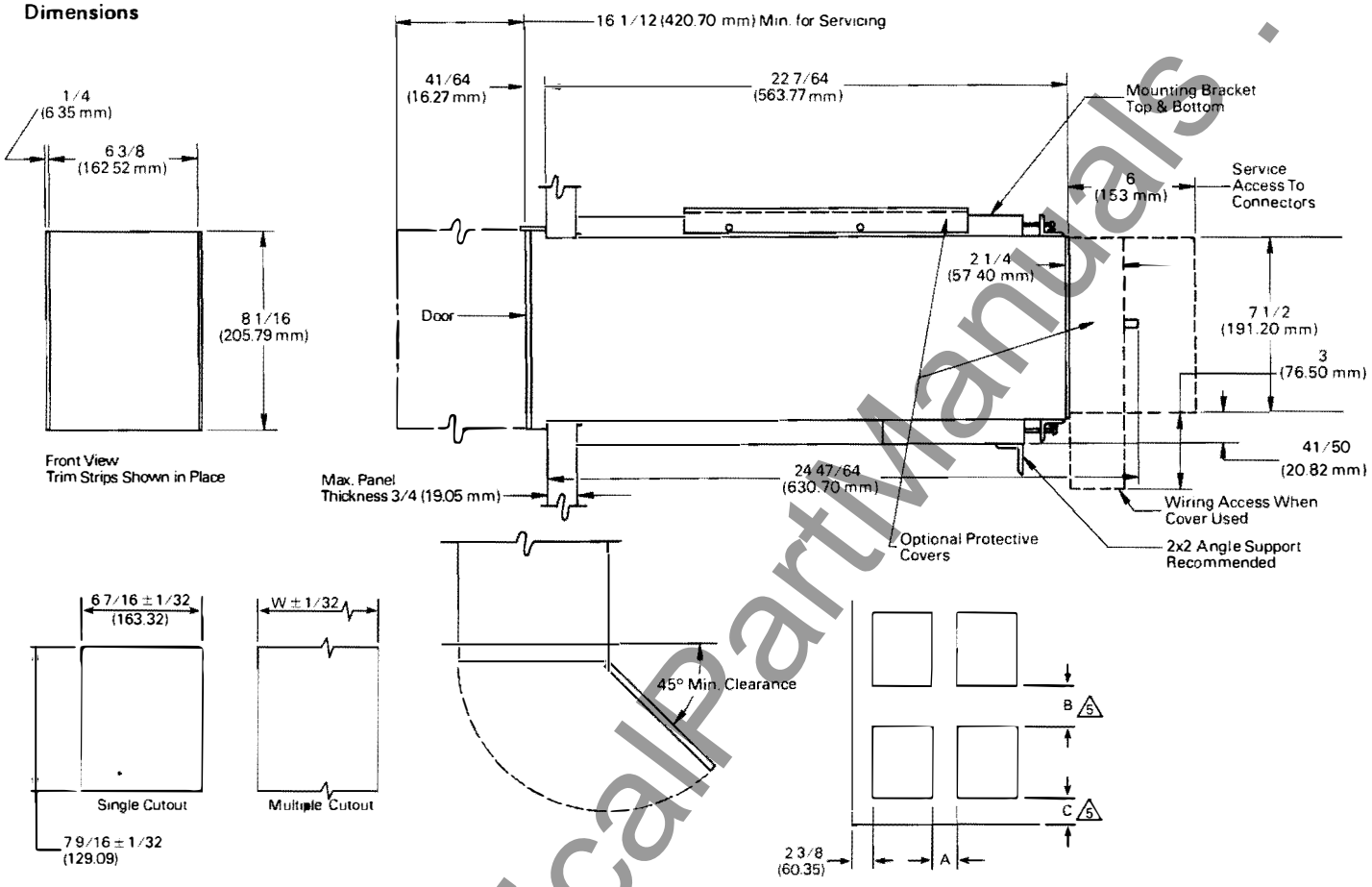
The SAMA logic diagram is representative of the control schemes that may be accopmplished with one Model GPC 1500A. The logic, as depicted, is for a fully metered, cross-limited combustion control, with Oxygen Trim, two-element feedwater control plus furnace pressure control.



The BLOCKWARE diagram, illustrates the similiarity between the Westinghouse BLOCKWARE configuration scheme to the SAMA logic diagram above. To configure the GPC 1500A, computer programming knowledge is not needed.



Dimensions



Panel Cutout for Interlocking Cases	
Number of Cases	W Cutout Width
1	6 7/16 (163.32)
2	12 13/16 (325.42)
3	19 1/8 (485.78)
4	25 9/16 (649.22)
5	31 15/16 (811.20)
6	38 5/16 (973.12)
7	44 11/16 (1135.05)
8	51 1/16 (1296.97)
9	57 7/16 (1458.97)
10	63 13/16 (1620.82)

Panel Cutout			
Panel Cutout Spacing	A	B	C
Minimum Recommended	1 3/4 (44.45)	3 7/16 (87.30)	2 3/4 (69.85)
With Rigid Conduit	2 3/4 (69.85)	4 3/16 (112.70)	2 3/4 (69.85)

Notes:
1. Dimensions are in inches and (millimeters), for example: 6(153.0).
2. Unless otherwise specified, dimensional tolerance is ± 1/8(3.17).
3. Trim strips are supplied loose, to be used as necessary.
4. Nominal weight:
   Standard _____ 25 lbs. 8 oz.
   W/protective covers _____ 26 lbs. 6 oz.
5. Panel cutouts shown are for standard Veritrak instruments. Additionally this instrument must have 3 inches minimum clearance top and bottom for ventilation. If microprocessors are mounted one above the another, 6 inches minimum clearance must be provided between them.

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TELEX: 986340

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