Integrated Control Station

(ICS)

Planning Manual

Rev 1, 11/13/03

INTRODUCTION

General:

The Integrated Control Station is a stand alone customized control unit that is based on the use of microprocessors. Therefore, it provides the simplicity and flexibility required by the operating situation as well as accommodating the requirements of intricate and complex process/instrumentation engineering and management in industrial and commercial facilities.

It is not expensive, factory deliveries are fast and installation is very straight forward so that managers can realize the ideals of fast "start up" and quick "payback".

Its features emphasize the motivations of managers, operators, engineers and instrument specialists involved with "PROCESS" instead of electronic and computer technologies.

The simplicity and flexibility of operation and maintenance are afforded by the customized front panel and modular I/O Terminal Panels. The front panel shows the process under control in either an outline or a graphical form. With prompter lights and digital LED readouts arranged in a manner that the processor operator understands, he can easily establish status of the process and the value of any process variable. The operator can change calibration and process set points with standard front panel controls in terms of engineering units. Operations are enhanced by computational power of the ICS and the computed data can be correlated with real time by an "on-board chronometer". The RS232C port provides transmission of ASCII data to other AGM products or computer systems. This provides a network for distributed processing of your control algorithm. Power failures will not effect the ICS's non-volatile RAM that does not require battery backup.

Changes in operating concept can easily be accommodated by changing the front panel or EPROM that was used for programming operating criteria that is not programmed by standard operator controls on the front panel.

Trouble shooting diagnostics with automatic test sequences verify correct operation of the ICS electronic circuits. The ICS can operate in 180 deg. F ambient temperatures. No requirements exist for purge fittings or compressed air to cool an enclosure.

No time requirements exist for any personnel to learn the computer system or remember data access codes. Distributed computing can mean the use of wire pairs in communication networks because the inherently lower data rates can be used in the network systems. Due to overall price, a complete 100% back up assembly can be installed in a fraction of an hour. Units can be provided that operate on as little as 150 mADC at 12 VDC for extraordinary applications at remote sites.

THEORY OF OPERATION AND CONSTRUCTION

The assembly contains two separate microprocessor systems (one called "PROCESS SYSTEMS" and the other called "FRONT PANEL SYSTEMS"), an Input/Output vestibule system, a front panel and rear panel.

The front panel contains displays and controls that are familiar to an operator. An LED digital display shows the value in engineering units of any specified function with the process systems. The other controls and adjustments are simple toggle switches and push buttons that do not require any complicated programming effort or knowledge of access codes. Process status information is displayed either by indicator lights on a menu or a color graphic.

The rear panel contains polarized connectors for connecting to the I/O Terminal Panels. Use of these external panels provides simplified installation and maintenance. A computer generated wiring table is provided for wiring these panels.

The ICS assembly is designed to accept and transit from one to eight analog signals, one to 32 input relay contacts, and one to 32 relay-coil voltage drives. The vestibule section is used for A/D, D/A, electronic scanning, special analog functions, buffers and transient protection. This section is always an AGM factory designed circuit and does not require any user adjustments.

MICROCOMPUTER SYSTEM OVERVIEW

Each system used two each CMOS 8-bit, MC146805, microprocessors within a computer architecture so that a single assembly can cascade several computer systems. The EPROM associated with the microprocessor is mounted in a zero-force socket. EEPROM technology is used for the non-volatile RAM. Conceptually, the ICS assembly has its own Distributive Computing and Local Area Network communication system.

Data handling and processing between the vestibule module, the Process System EPROM and the Front Panel EPROM is very effective. In many respects, ICS is a hybrid microcomputer system using the inherent advantages of analog and digital computers simultaneously. The vestibule module section contains the A/D and D/A converters, scanner, and other analog devices so that I/O can be efficiently handled by the multiple microprocessor system where each microprocessor has its own multitasking capability within each microprocessor. Factory programming has been optimized for the intended application of the ICS. The programming has been developed so that a high level AGM language using object oriented programming techniques along with extensive AGM production software provides ample support to customized requirements. It should be noted the ICS users can do their own programming if they choose to do so. AGM will furnish the information required for programming the ICS.

The communication bus is very flexible. Provisions are made so that the assembly is furnished with RS232C.

Standard factory programming includes diagnostics to assure an operator that the assembly is functioning correctly. Upon power-up, the ICS automatically causes the front panel digital display to scroll "ICS UP". Error codes on the display alert the operator to a problem.

The external power supply furnished with the assembly operates from 117VAC 50 or 60 Hz. In the event of a power interruption, preferred data is automatically stored in the non-volatile RAM. When power is restored, this data is restored to the operating system.

HOW TO ORDER

When you want to reorder a unit like a unit you have ordered before, state your previous purchase order number as a part number or use the AGM serial number as a part number. When you are ordering the first time or ordering a new assembly, use the set of planning and specification forms included with this manual. These forms have been designed for the convenient coordination of the managerial, engineering and operating aspects of a stand-alone control station in straight forward terms. A simple set of forms is included to illustrate a typical control system application. If there is any doubt or question in preparing your form, call, write, or fax to:

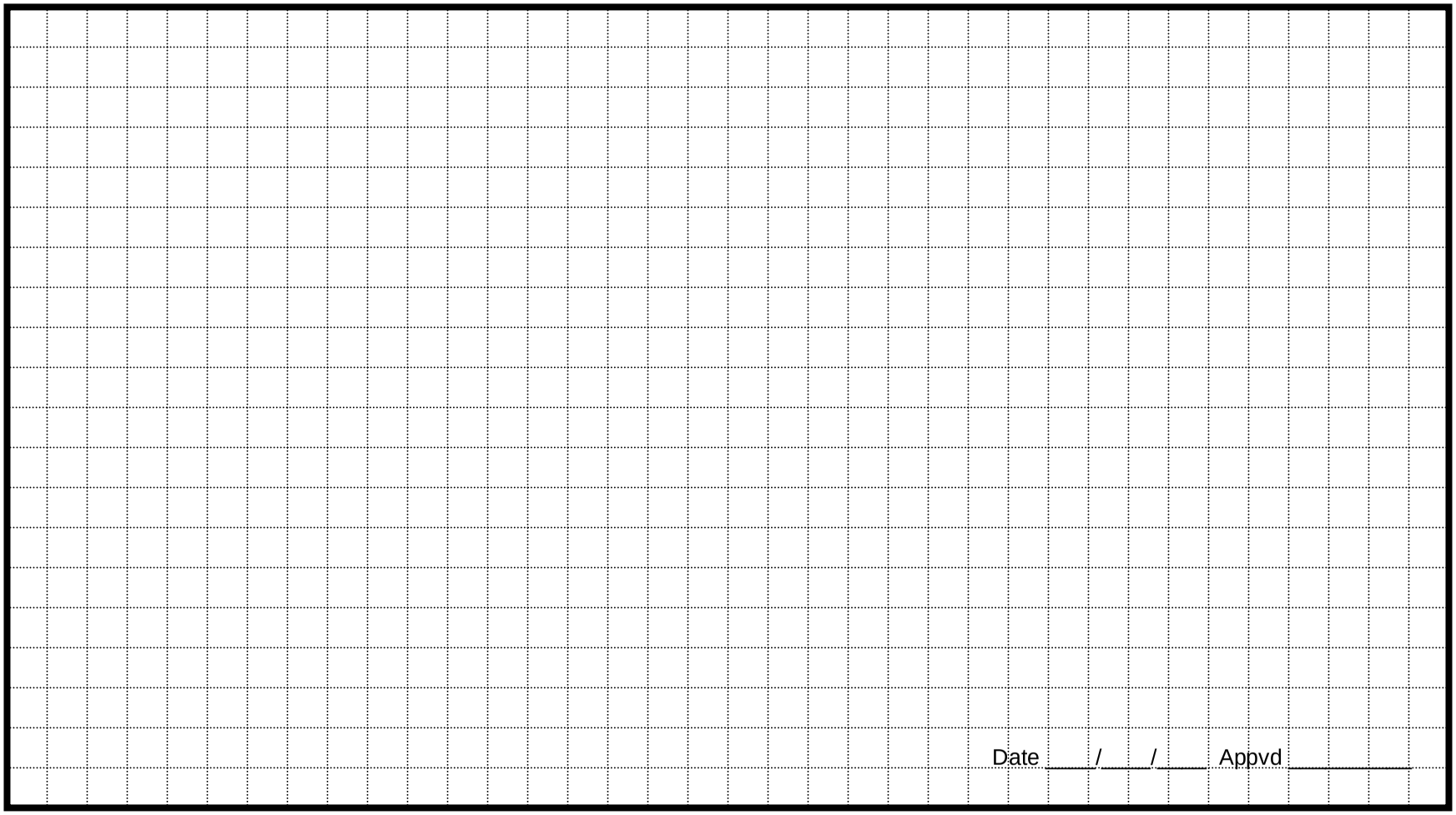
AGM ELECTRONICS,INC. P.O. BOX 32227
TUCSON, ARIZONA 85751-32227
4260 N Sullinger Ave
TUCSON, ARIZONA 85705

VOICE: (520) 722-1000
FAX: (520) 722-1045
E-Mail: tech@agmelectronics.com

Your inquiry will be promptly handled by AGM's engineering/sales staff.

CONTROL SPECIFICATION

_____
(title)



PURPOSE: This form diagrams the specified control scheme to illustrate the relationship of all variables in terms of desired variables, computations, manipulation, and calibration. When completed, it becomes the reference for specifying the front/ back panels, the operator controls and displays and the EPROM programming.

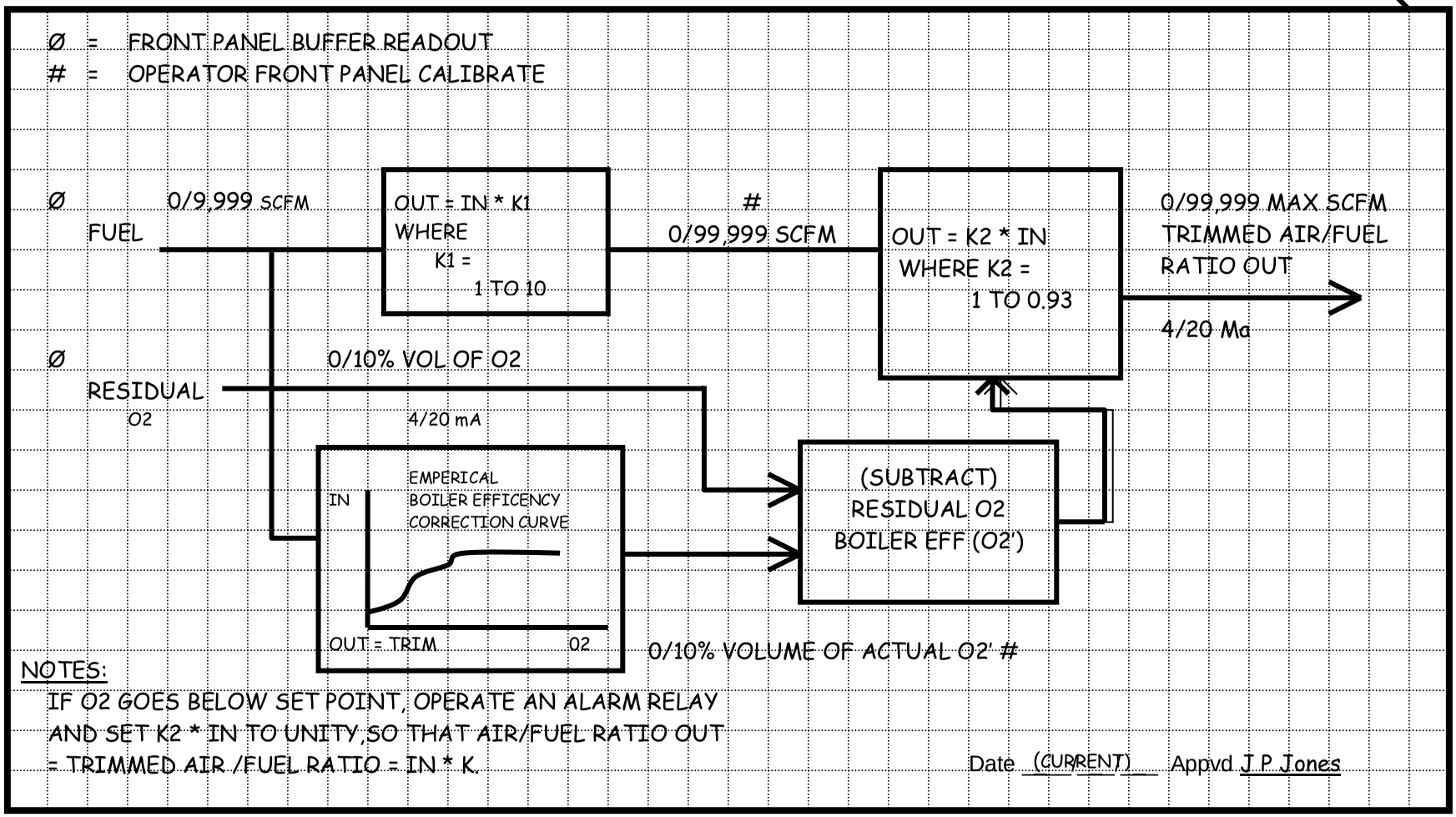
INSTRUCTIONS: (1) Draw a one line diagram. (2) Show the ICS "Inputs" on the left and the "outputs" on the right side of the form. (3) Identify with the "O" symbol the variables to be selectable for the front panel readouts. (4)Identify with a "#" symbol those variables for change or recalibration by front panel controls. (5) Show the 0/100 % engineering values above the line at each junction on the one line diagram. Where applicable show the corresponding analog values directly below the engineering values.

CONTROL SPECIFICATION

SAMPLE

BOILER CONTROL, OXYGEN TRIM

(title)



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OPERATIONS PLANNING SHEET

In your own words fill in the following:

1. What do you want this controller to do:

2. Describe interlocks or "what if" situations you want in your controller operation. For example, if a momentary power interruption occurs, I want…., or what if I loose one input signal, I want.....

Date: ___/___/___
Approved:

OPERATIONS PLANNING SHEET

SAMPLE

In your own words fill in the following:

1. What do you want this controller to do:

I want a 4/20 mADC set point signal to use with my air valve PID controller that is trimmed for oxygen in the combustion stack. The oxygen being measured in the stack is to be adjusted for boiler efficiency. The boiler efficiency is an empirical curve and varies from boiler to boiler. A table, load vs. O2, is attached. I want to calibrate this from the front panel.

2. Describe interlocks or "what if" situations you want in your controller operation. For example, if a momentary power interruption occurs, I want…., or what if I loose one input signal, I want.....

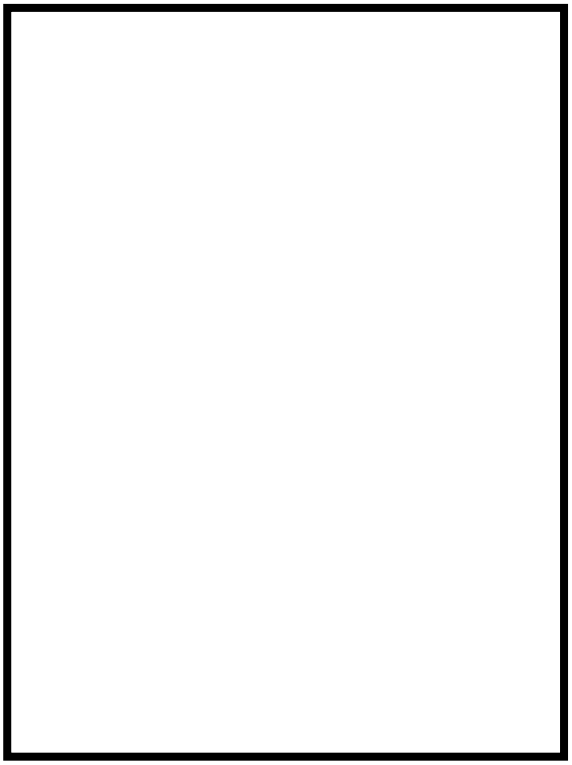
If the O2 analyzer input fails, I want the set point output to be the air/fuel ratio setting from the front panel to be the set point output. I also want a relay to sound an audio alarm.

Date: (CURRENT)
Approved: JPJ

FRONT PANEL LAYOUT

Preliminary Panel Layout Sheet

(not to any scale)



TITLES

(Write desired titles in space and show locations with arrows)

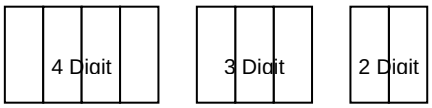
Date _____/_____/_____

Apprvd _____

Purpose: This form is used to help you plan the format of your front panel prior to laying it out on the actual size form. It will help you decide if you want a menu or a graphic layout.

Instructions: Step (1), sketch the digital display section at the top of the panel using one "UP/DOWN" toggle and "ENTER" push button. These are required for setting operating values and calibration. These switches are almost always required, they are used to set the operating set points and calibration values. Typically these are located in the upper right, however, they may be located at any other unused location. Step (2), layout the Basic control section of the panel showing the push-on/off "CALIBRATE", "SET POINT", "DISPLAY MODE" and "SEQUENCE" buttons and status lights. These switches are normally included on the front panel, but Dry Contact Inputs on the Digital I/O Panels may also be used for connection to a key switch. This will provide access control over the calibrate and set point modes. Step (3), layout the graphic or menu section of the control panel. The faintly marked outline shows the locations options you have for locating lights, push buttons and toggle switches. Show a push button as a small black circle, a steady on/off light as a circle, and an on/off/blinking light as circle with an "x" through it. Step (4), label your panel. Later, make sure the panel layout agrees with the Front Panel Operations form that you will develop later. Step (5), check your layout so that you do not have more than two digital displays or a total of more than 8 digits. Also check that you do not have more than 32 lights and 16 SPST switch closures. Note a SPDT counts as two SPST. If you exceed these limits, replan your layout. When you are satisfied with your preliminary layout, use the dimensions below and proceed to sketch and label the actual size panel using the digital display dimensions and the location options below.

Digital Display Options



LEGEND:

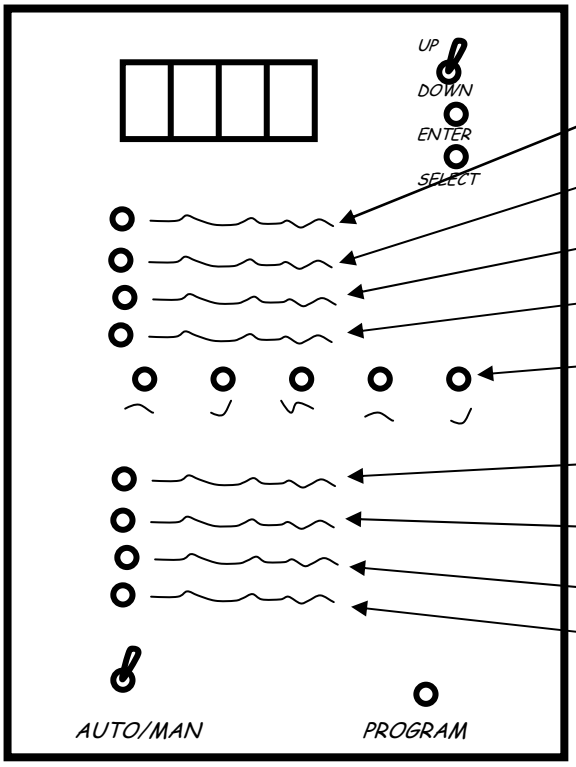
SWITCH:	Ø	TOGGLE
	•	PUSH BUTTON
LIGHT:	(X)	BLINKING
	[X]	ON/OFF/BLINKING
	X	ON/OFF

FRONT PANEL LAYOUT

SAMPLE

Preliminary Panel Layout Sheet

(not to any scale)



TITLES

(Write desired titles in space and show locations with arrows)

O OXYGEN (0/10%)

O ACTUAL FUEL FLOW (SCFM)

O AIR/FUEL RATIO (10% MAX)

O PROGRAM BOILER EFFICENCY CURVE % LOAD

O O O O O

20 40 60 80 100

O OUTPUT BOILER EFFICENCY

O CORRECT O2

O COMPENSATED AIR SET POINT (0/99,999SCFM)

O O2 LO / ALARM SET POINT

Date (CURRENT)

Apprvd JPJ

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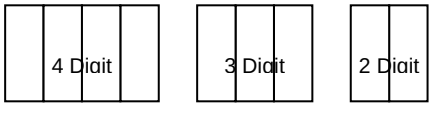
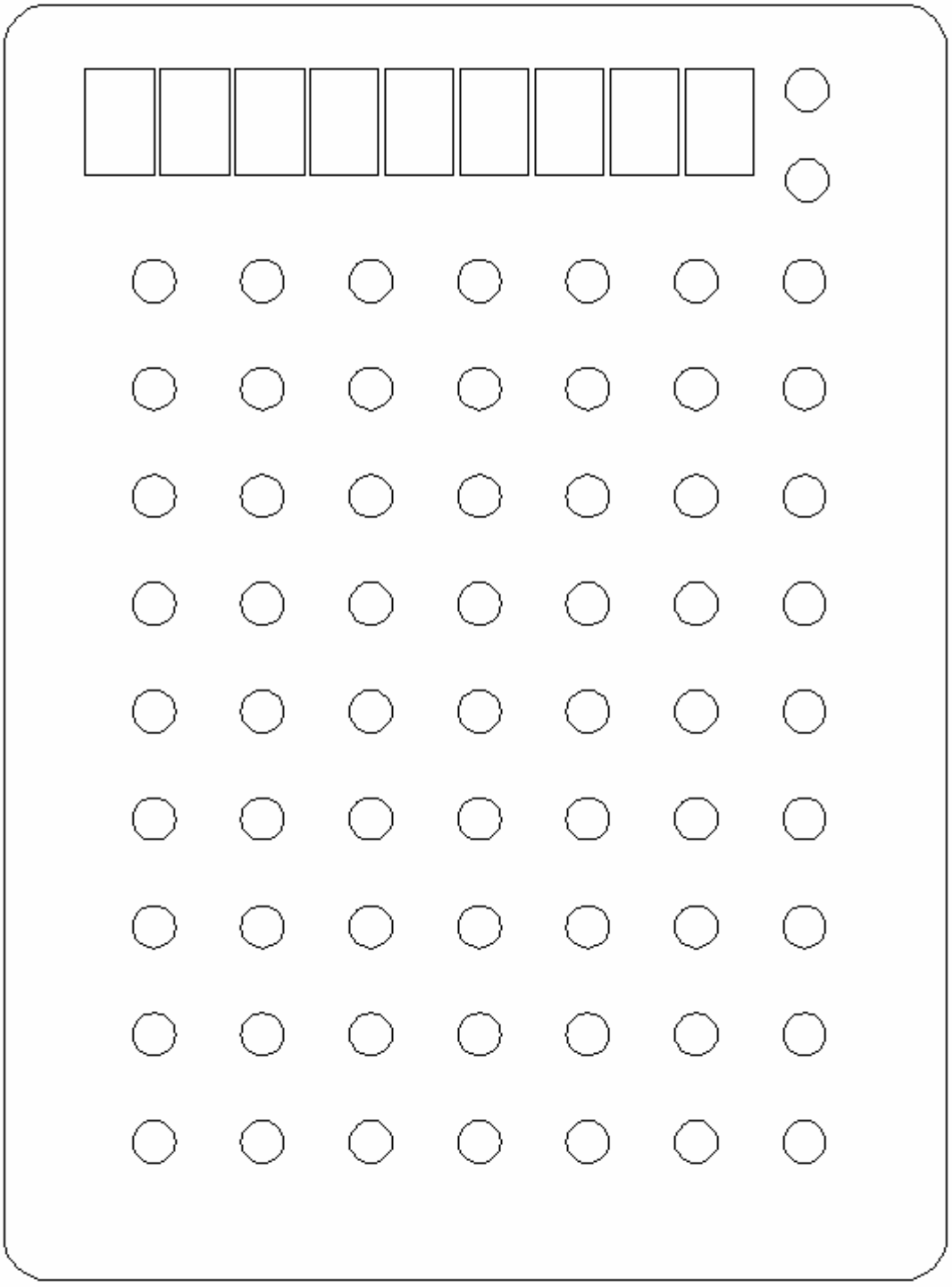


LEGEND:

SWITCH:	Ø	TOGGLE
	•	PUSH BUTTON
LIGHT:	(X)	BLINKING
	[X]	ON/OFF/BLINKING
	X	ON/OFF

FRONT PANEL SPECIFICATION SHEET

(ACTUAL SIZE)



TOGGLE SWITCH

PUSH BUTTON

LIGHT ON/OFF

LIGHT BLINKING

LIGHT ON/OFF/BLINKING

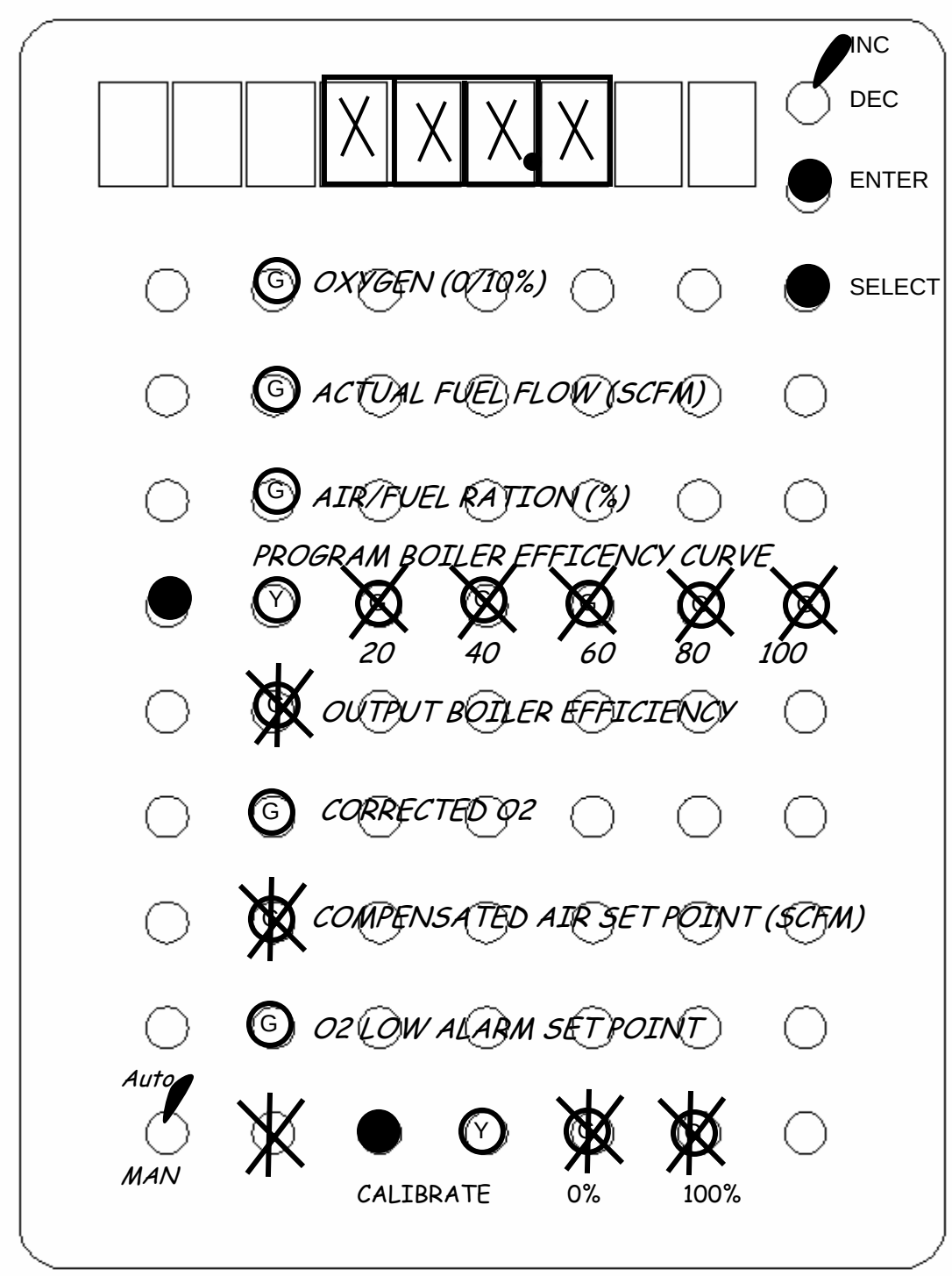
C = R FOR RED
G FOR GREEN
Y FOR YELLOW
B FOR BLUE

Date _____/_____/_____
Apprvd _____

SAMPLE

FRONT PANEL SPECIFICATION SHEET

(ACTUAL SIZE)



TOGGLE SWITCH

PUSH BUTTON

C LIGHT ON/OFF

LIGHT BLINKING

LIGHT ON/OFF/BLINKING

C = R FOR RED
G FOR GREEN
Y FOR YELLOW
B FOR BLUE

Date (Current)
Apprvd JPJ

INPUT AND OUTPUTS TERMINAL LABELS

Enter desired labels below. Terminals accept 18 to 22 gage wire.

Analog In				Analog Out			
1	_____	5	_____	1	_____	5	_____
2	_____	6	_____	2	_____	6	_____
3	_____	7	_____	3	_____	7	_____
4	_____	8	_____	4	_____	8	_____

Digital In				Digital Out			
1	_____	17	_____	1	_____	17	_____
2	_____	18	_____	2	_____	18	_____
3	_____	19	_____	3	_____	19	_____
4	_____	20	_____	4	_____	20	_____
5	_____	21	_____	5	_____	21	_____
6	_____	22	_____	6	_____	22	_____
7	_____	23	_____	7	_____	23	_____
8	_____	24	_____	8	_____	24	_____
9	_____	25	_____	9	_____	25	_____
10	_____	26	_____	10	_____	26	_____
11	_____	27	_____	11	_____	27	_____
12	_____	28	_____	12	_____	28	_____
13	_____	29	_____	13	_____	29	_____
14	_____	30	_____	14	_____	30	_____
15	_____	31	_____	15	_____	31	_____
16	_____	32	_____	16	_____	32	_____

Date _____/_____/_____
Apprvd _____

SAMPLE

INPUT AND OUTPUTS TERMINAL LABELS

Enter desired labels below. Terminals accept 18 to 22 gage wire.

Analog In

1	FUEL	5	
2	O2	6	
3		7	
4		8	

Analog Out

1	S. P. OUT	5	
2		6	
3		7	
4		8	

Digital In

1		17	
2		18	
3		19	
4		20	
5		21	
6		22	
7		23	
8		24	
9		25	
10		26	
11		27	
12		28	
13		29	
14		30	
15		31	
16		32	

Digital Out

1	O2 ALARM	17	
2		18	
3		19	
4		20	
5		21	
6		22	
7		23	
8		24	
9		25	
10		26	
11		27	
12		28	
13		29	
14		30	
15		31	
16		32	

Date (Current)
Apprvd JPJ

DISPLAY AND SET POINT SEQUENCE

Enter on the following tables description of the operational values you wish displayed. Enter in the sequence you wish to display the values when the "SEQUENCE" button is pressed. The first value entered will be the first value displayed on power up or return to the normal display mode.

	Left Display			Right Display (If used)			
1	_____	17	_____	1	_____	17	_____
2	_____	18	_____	2	_____	18	_____
3	_____	19	_____	3	_____	19	_____
4	_____	20	_____	4	_____	20	_____
5	_____	21	_____	5	_____	21	_____
6	_____	22	_____	6	_____	22	_____
7	_____	23	_____	7	_____	23	_____
8	_____	24	_____	8	_____	24	_____
9	_____	25	_____	9	_____	25	_____
10	_____	26	_____	10	_____	26	_____
11	_____	27	_____	11	_____	27	_____
12	_____	28	_____	12	_____	28	_____
13	_____	29	_____	13	_____	29	_____
14	_____	30	_____	14	_____	30	_____
15	_____	31	_____	15	_____	31	_____
16	_____	32	_____	16	_____	32	_____

Date _____/_____/_____
Apprvd _____

SAMPLE

DISPLAY AND SET POINT SEQUENCE

Enter on the following tables description of the operational values you wish displayed. Enter in the sequence you wish to display the values when the "SEQUENCE" button is pressed. The first value entered will be the first value displayed on power up or return to the normal display mode.

	Left Display			Right Display (If used)			
1	OXYGEN	17		1		17	
2	FUEL FLOW	18		2		18	
3	AIR/FUEL	19		3		19	
4	OUTPUT EFF	20		4		20	
5	CORR_O2	21		5		21	
6		22		6		22	
7		23		7		23	
8		24		8		24	
9		25		9		25	
10		26		10		26	
11		27		11		27	
12		28		12		28	
13		29		13		29	
14		30		14		30	
15		31		15		31	
16		32		16		32	

Date (Current)
Apprvd JPJ