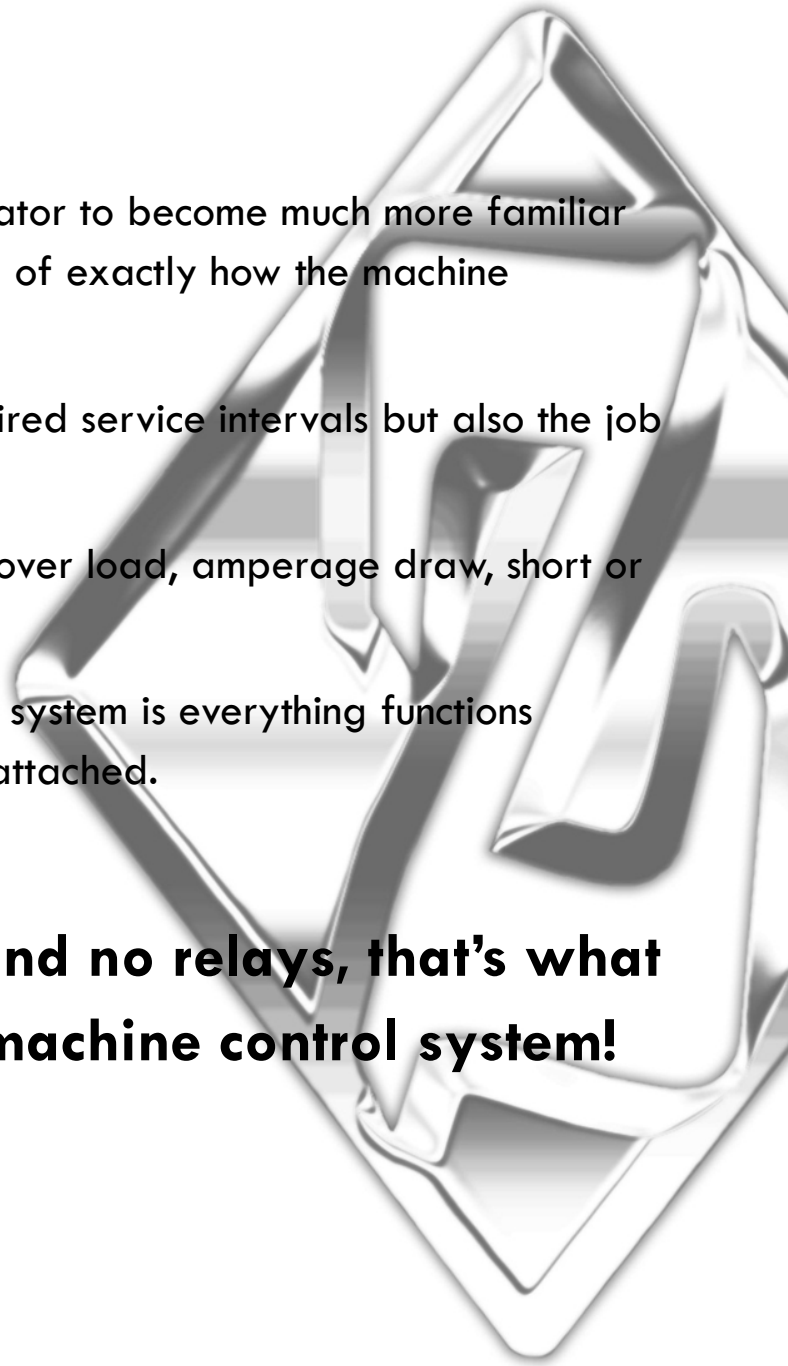
Diamond Z

Electronic Control System

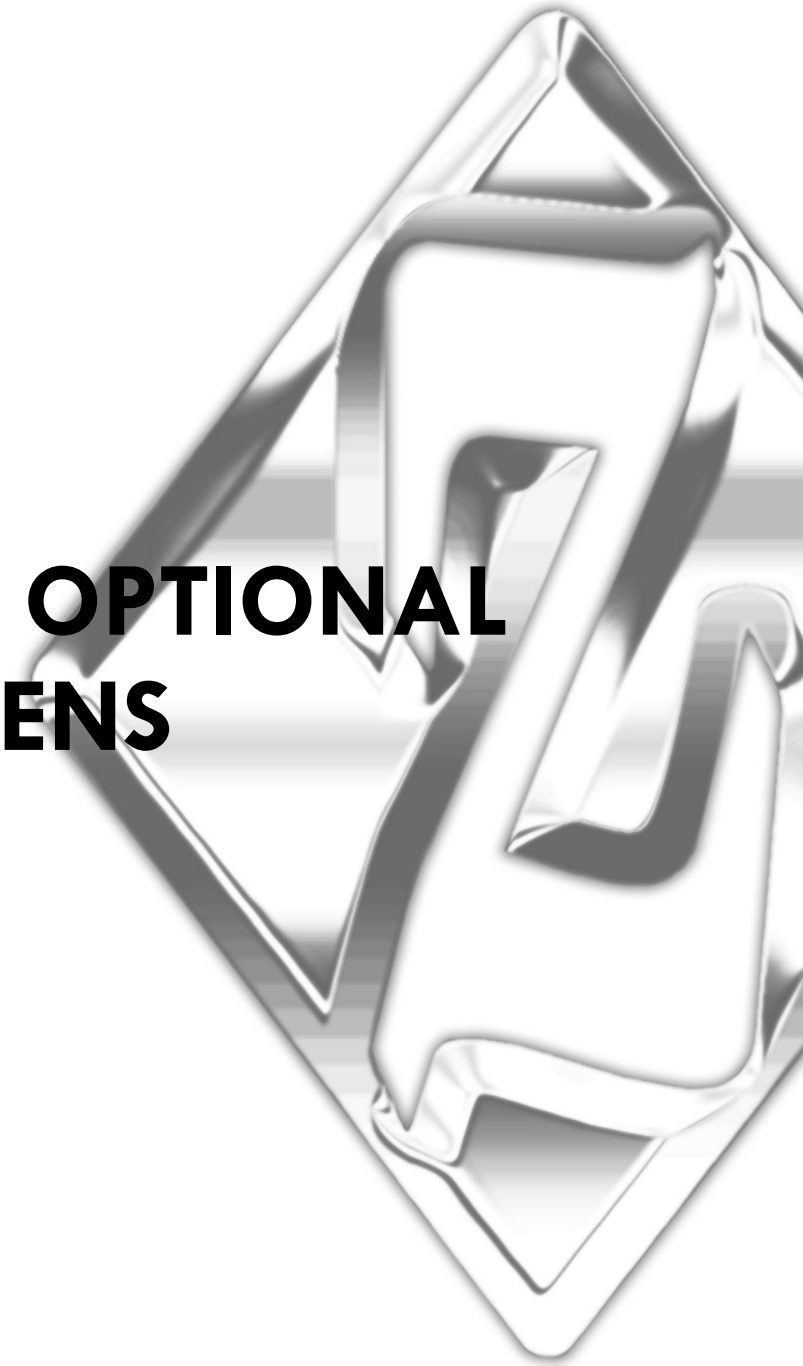
- The NEMA4 rated machine control PLC coupled with the NEMA 4 rated LCD screen built by Murphy for Eaton makes this control system one of the most efficient state of the art control system available to day.
- Coupled with precision programing and a clear, experienced understanding of grinding mechanics and engine management further enhance the benefit to the performance and self diagnostic capabilities of all of our machines.
- This system takes the place of standard engine analog gauges, the engine messenger reader screen as well as all the caution and warning lights.
- The screen also offers the convenience of illustrating exactly what and when the control plc is telling the machine to do for ease of operation and trouble shooting.

- This state of the art control system will allow the operator to become much more familiar with his machine while gaining a better understanding of exactly how the machine functions.
- Added features allow you to track not only your required service intervals but also the job hours and all of your critical component data.
- The self diagnostic screen will tell you if you have an over load, amperage draw, short or multiple other potential electrical malfunctions.
- All of this and more but the most amazing part of this system is everything functions exactly as designed even with out the reader screen attached.

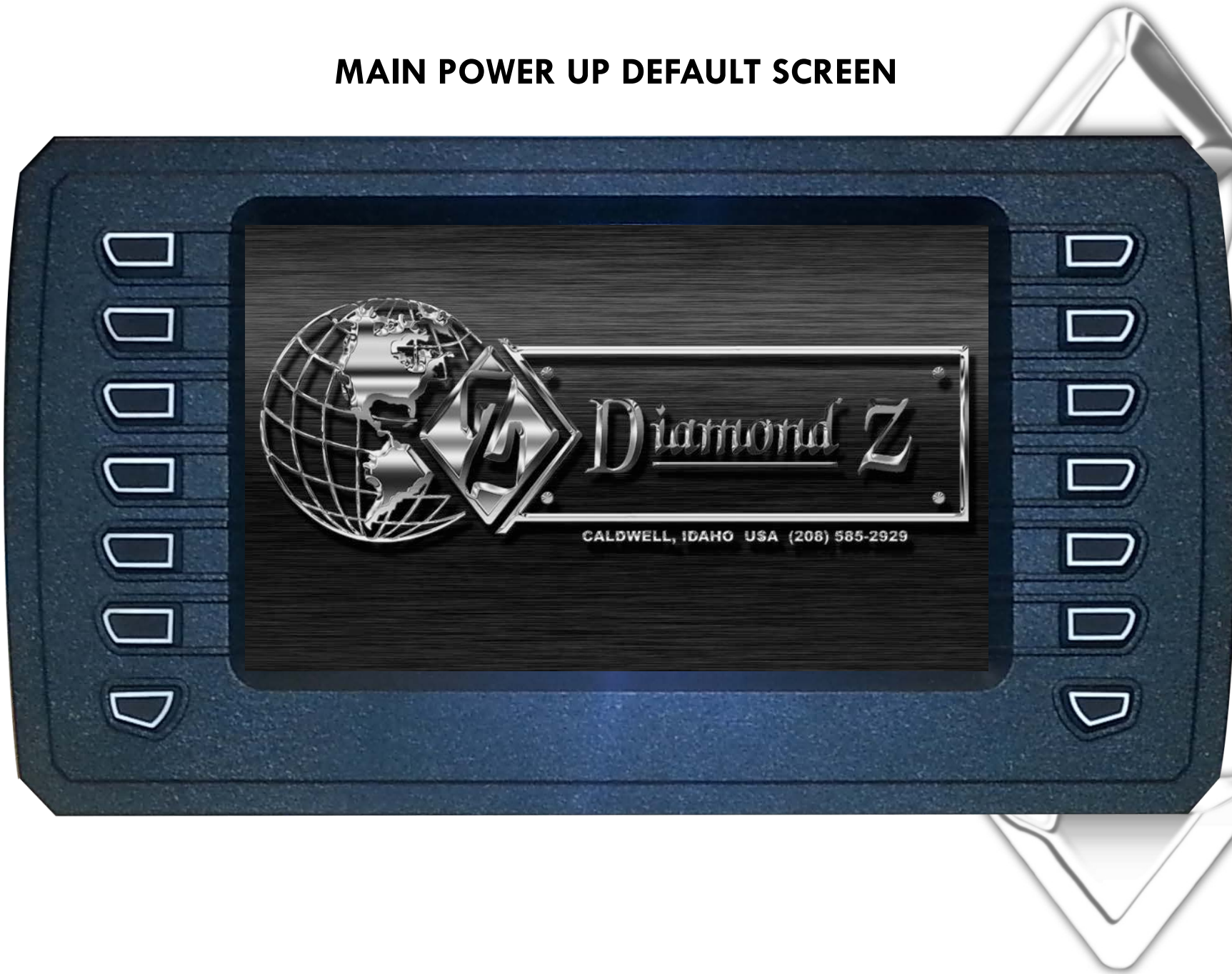


- **Oh, and one more thing all of this and no relays, that's what I said not one single relay in this machine control system!**

MAIN DEFAULT AND OPTIONAL GAUGE SCREENS



MAIN POWER UP DEFAULT SCREEN



ANALOG GAUGE SCREEN

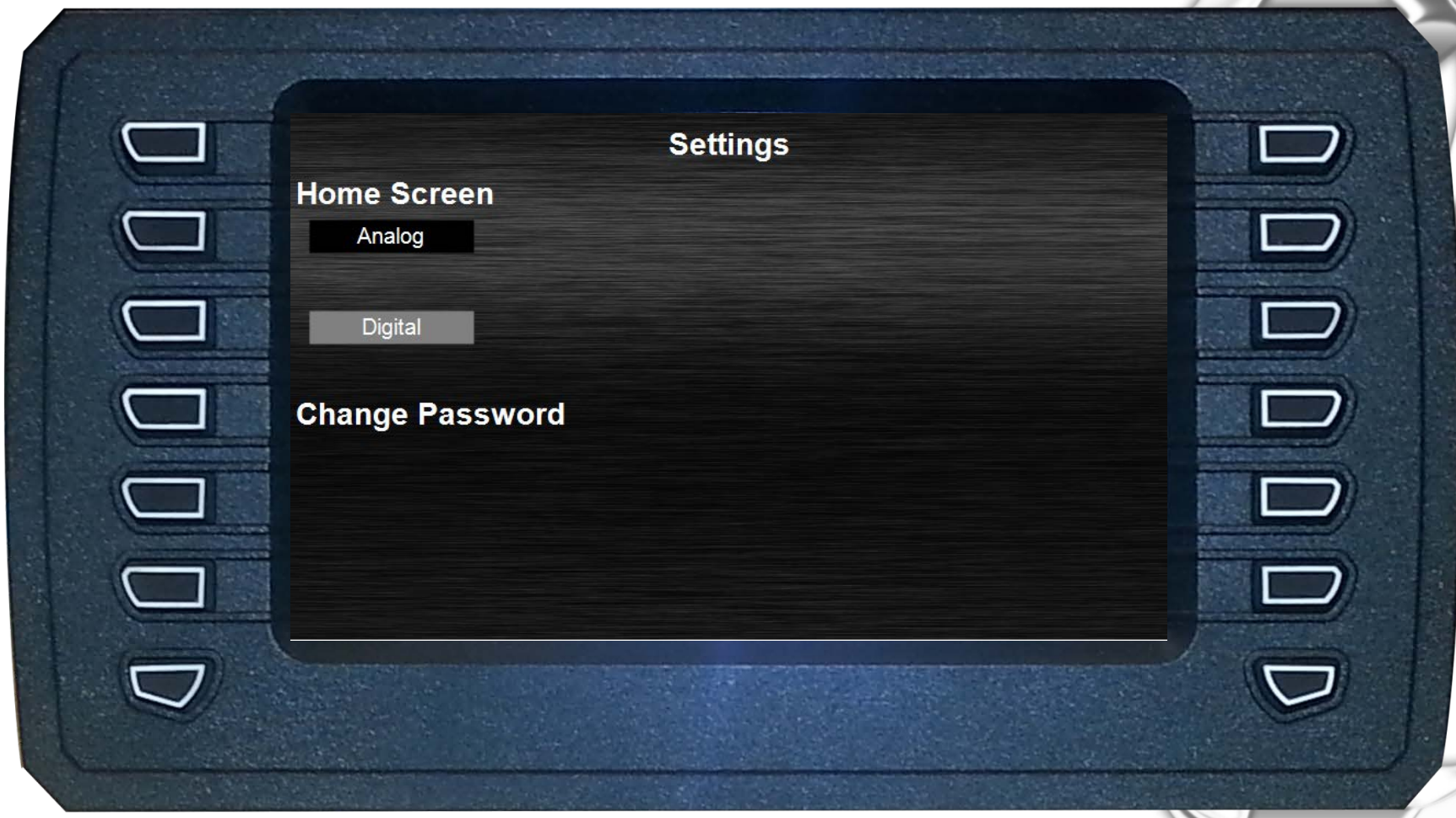
Screen Scroll Forward

Any time you cycle the start key the screen will default back to the analog screen or the digital screen

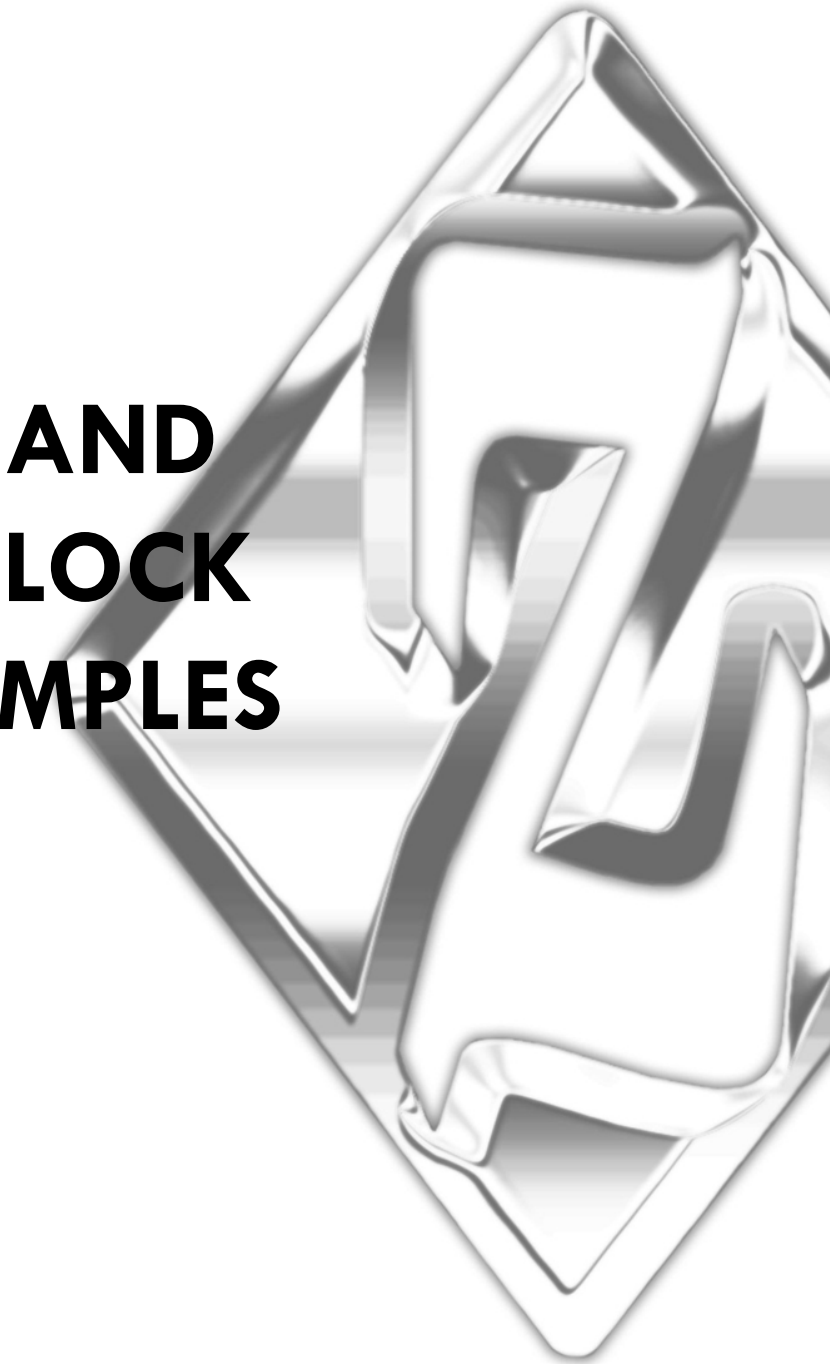
Screen scroll back

DIGITAL GAUGE SCREEN

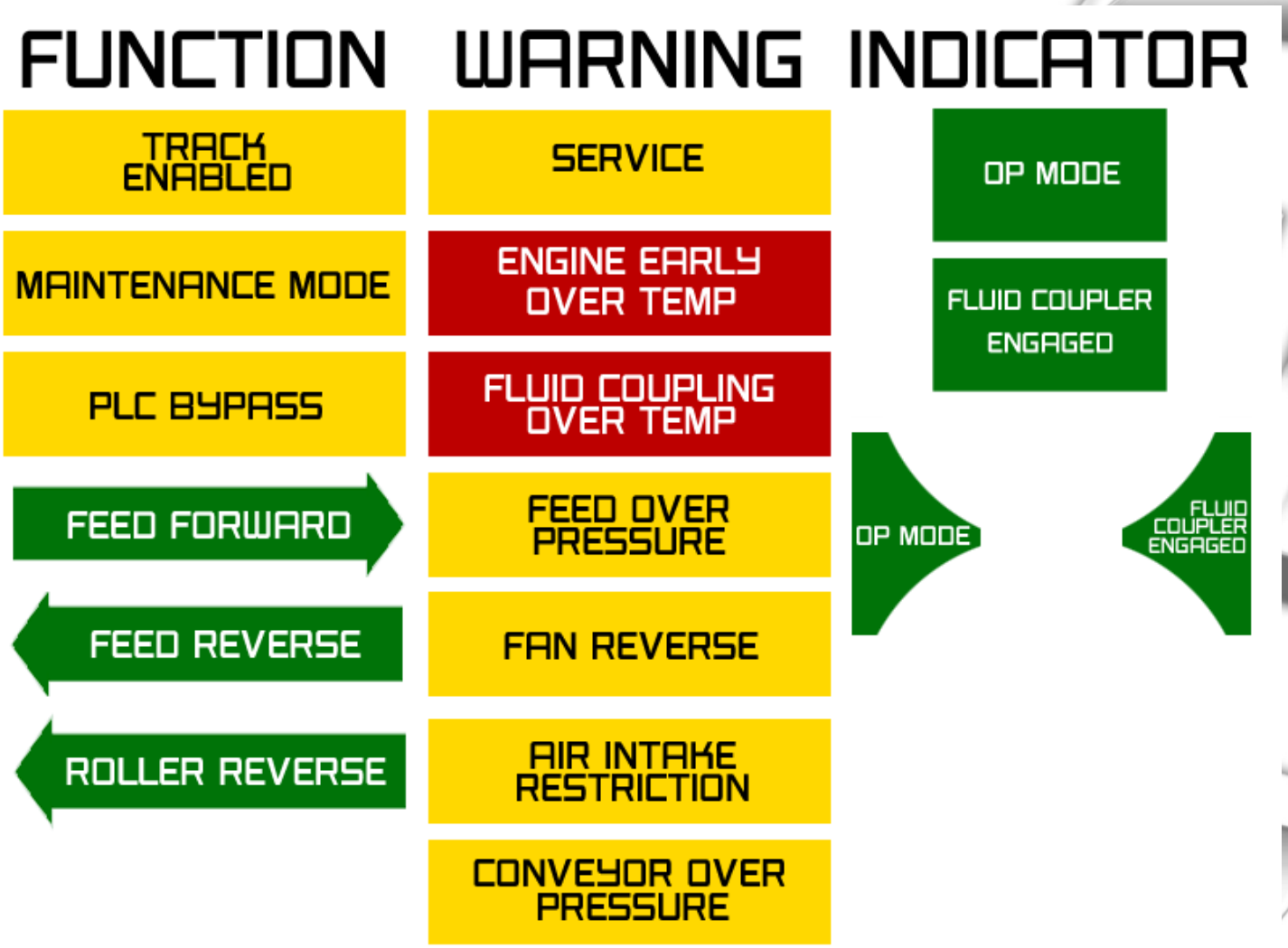
SETTINGS SCREEN FOR SETTING THE SCREEN TYPE FROM ANALOG TO DIGITAL: OR CHANGE YOUR PASSWORD.



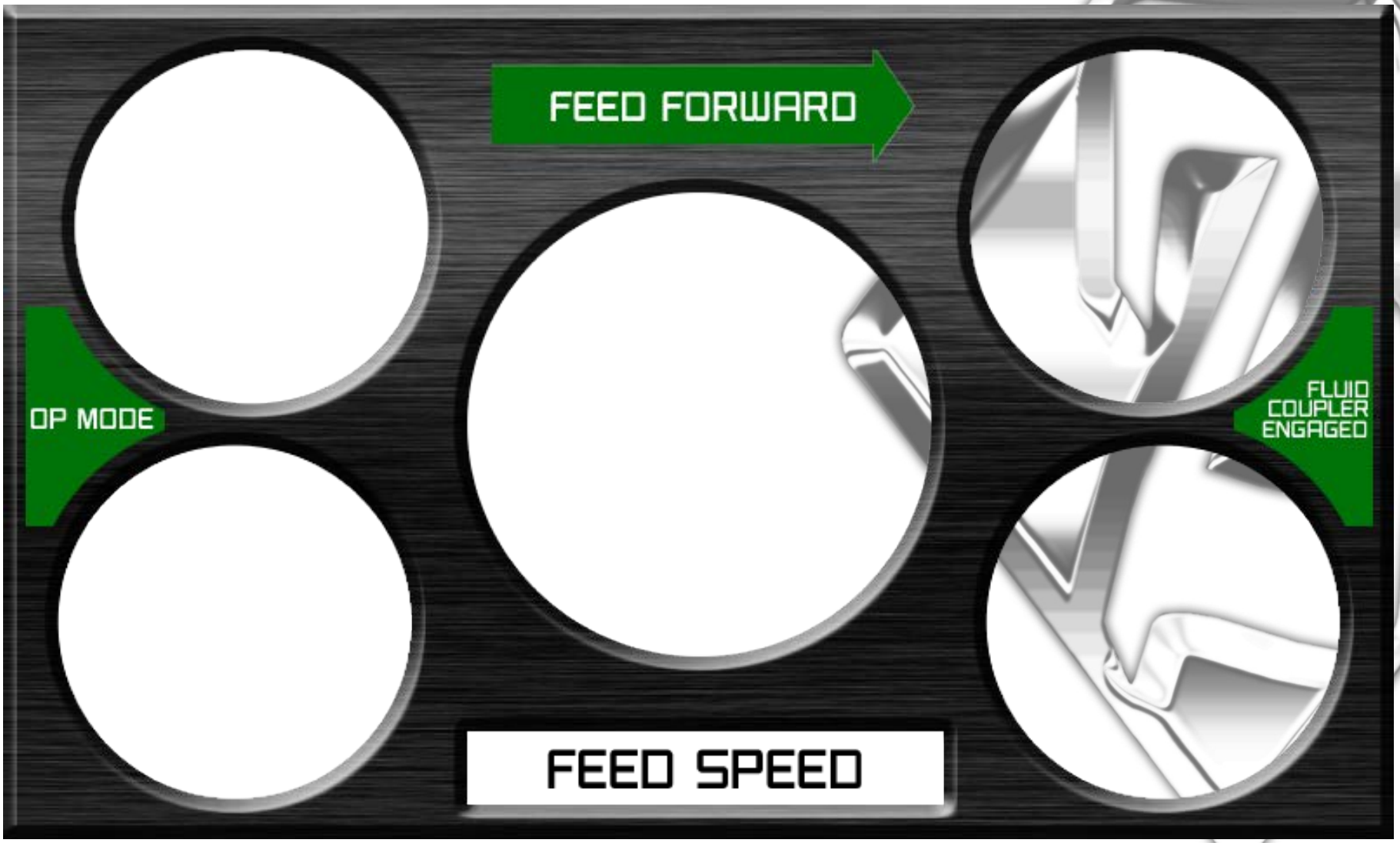
FUNCTION AND WARNING BLOCK SCREEN EXAMPLES



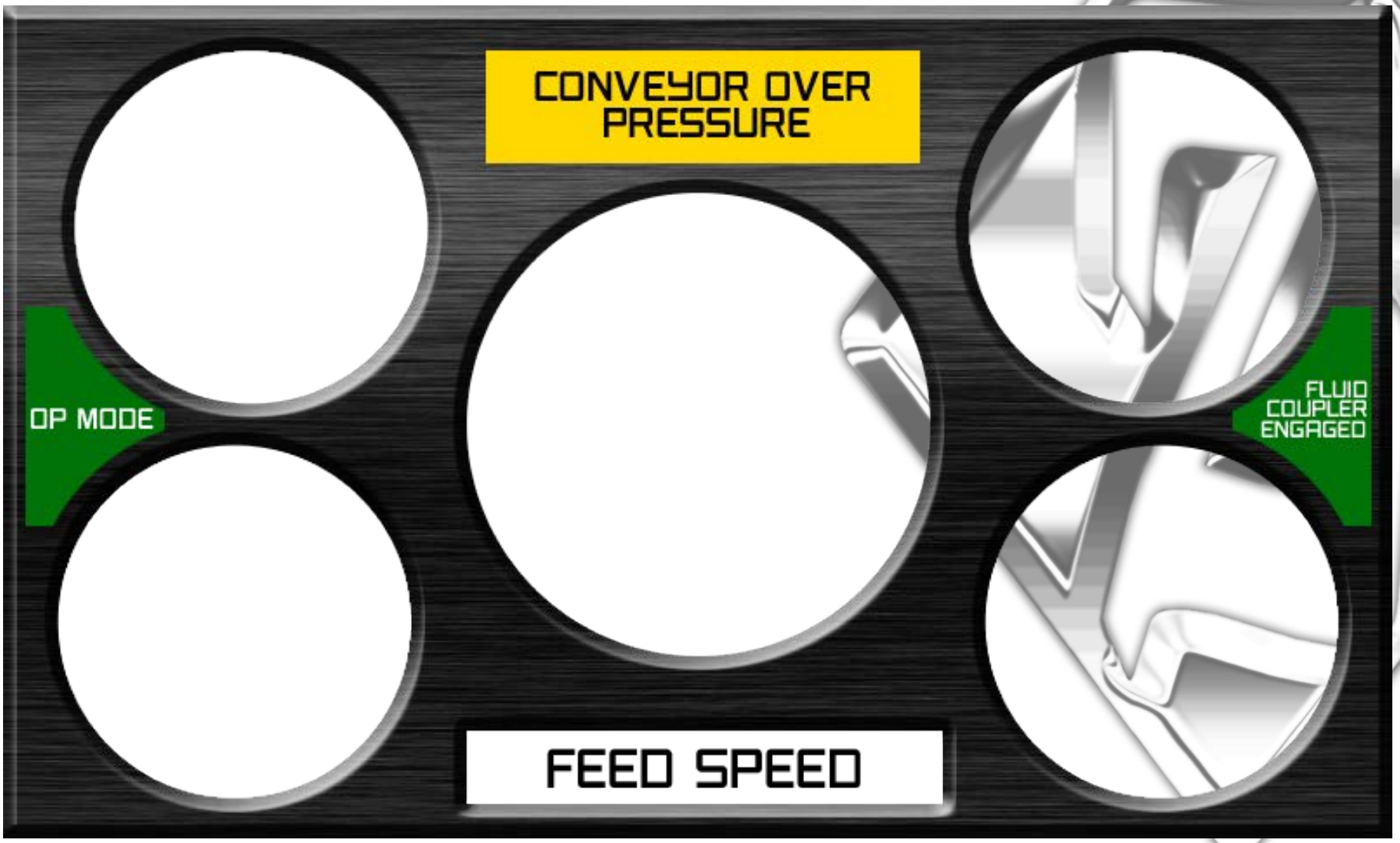
FUNCTION AND WARNING BLOCKS



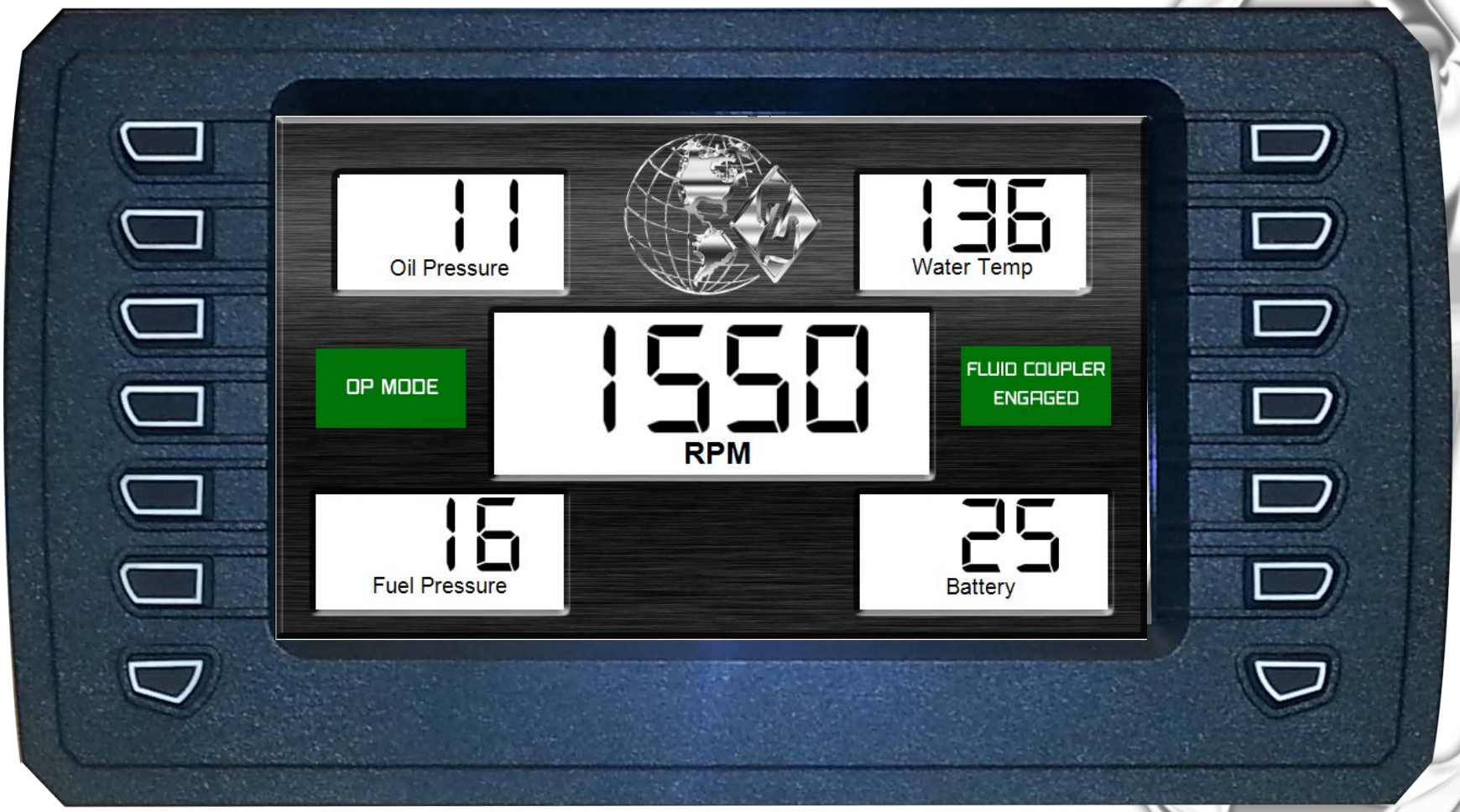
MAIN SCREEN WITH FUNCTION BLOCKS ILLUSTRATED



MAIN SCREEN WITH WARNING BLOCK ILLUSTRATED

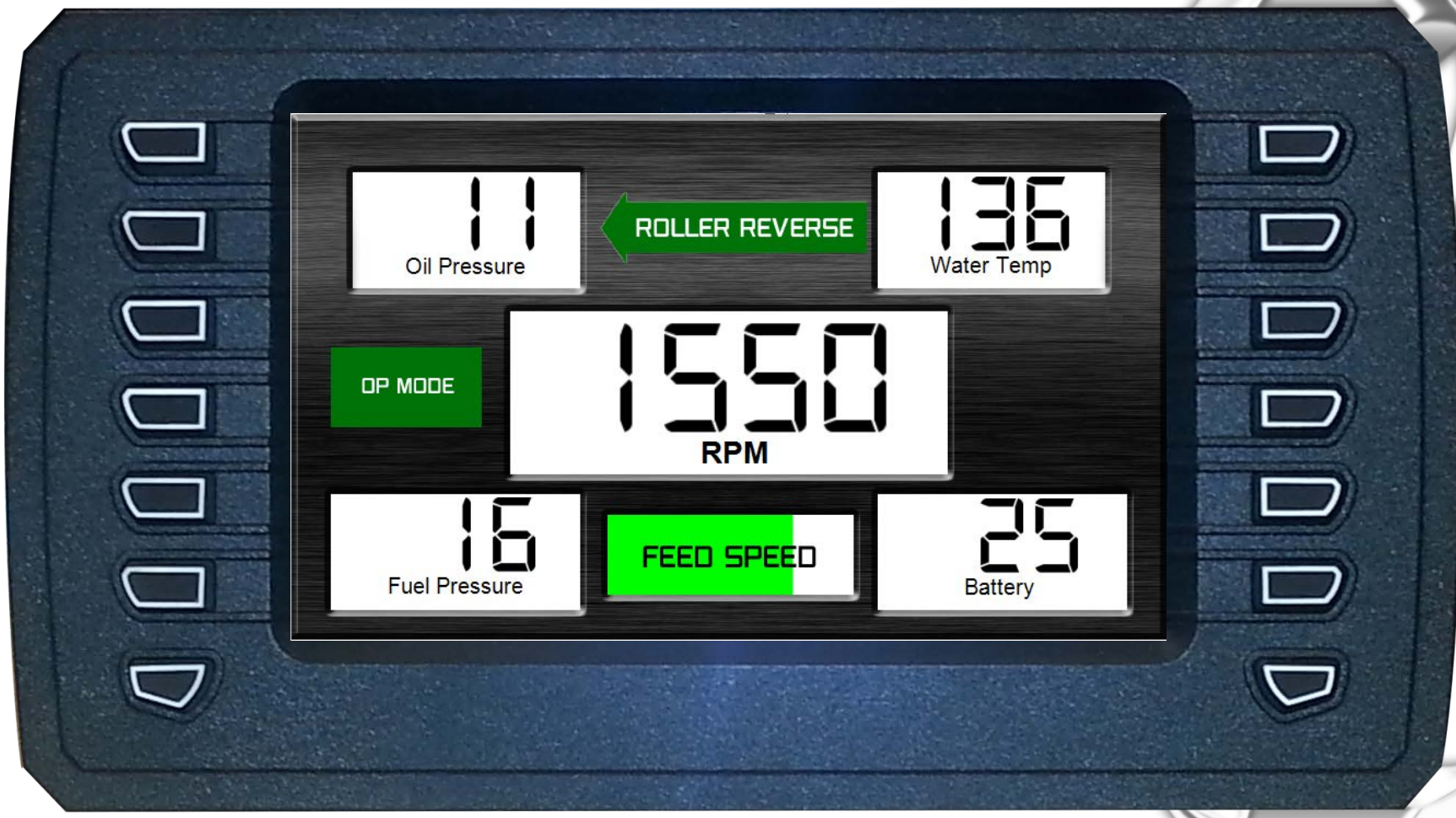


DIGITAL GAUGE SCREEN IS SHOWING THE FLUID COUPLER FUNCTION ENGAGED



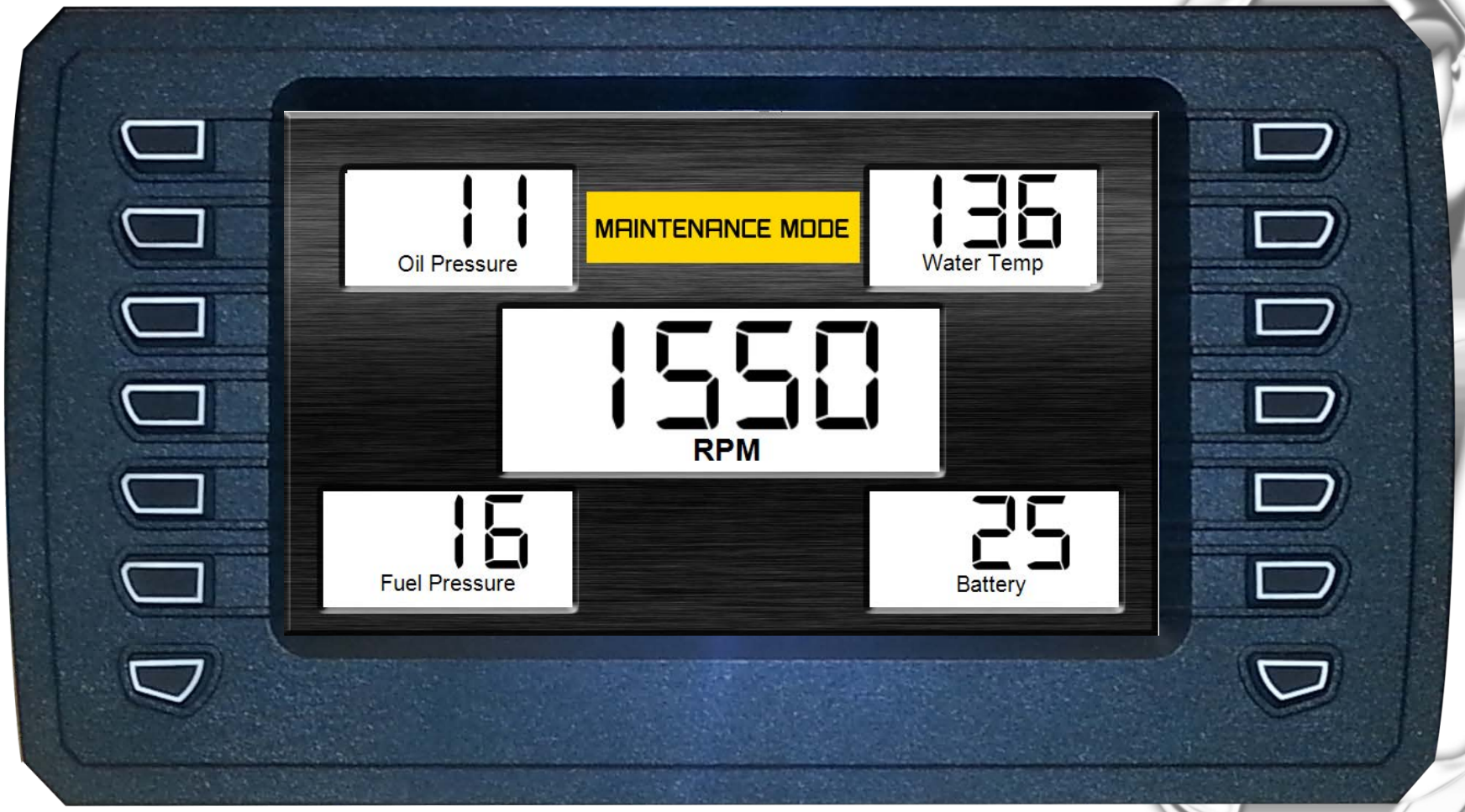
DIGITAL SCREEN SHOWING THE OP MODE/ FEED FORWARD/FEED SPEED SETTING WITH FLUID COUPLER ENGAGED

DIGITAL GAUGE SHOWING ROLLER REVERSE/FEED SPEED /FLUID COUPLER OFF



DIGITAL SCREEN SHOWING FEED REVERSE & FEED SPEED WITH FLUID COUPLER OFF

MAINTENANCE MODE



Maintenance mode is enabled when tub/crush roller are hydraulically pin in the safe maintenance position. When in this position the mill will no engage

Faults, cautions and warnings

Digital Screen will flash every 2sec showing Data Connection Lost: Will need to check the Data link coming to the screen? The machine will function with Data Connection lost.

Digital Screen flashes every 2sec Showing Conveyor Over Pressure: This Will Shut the Feed System OFF. After the Conveyor Pressure Drops be low 1800psi the screen will go back to Normal and Feed will resume.

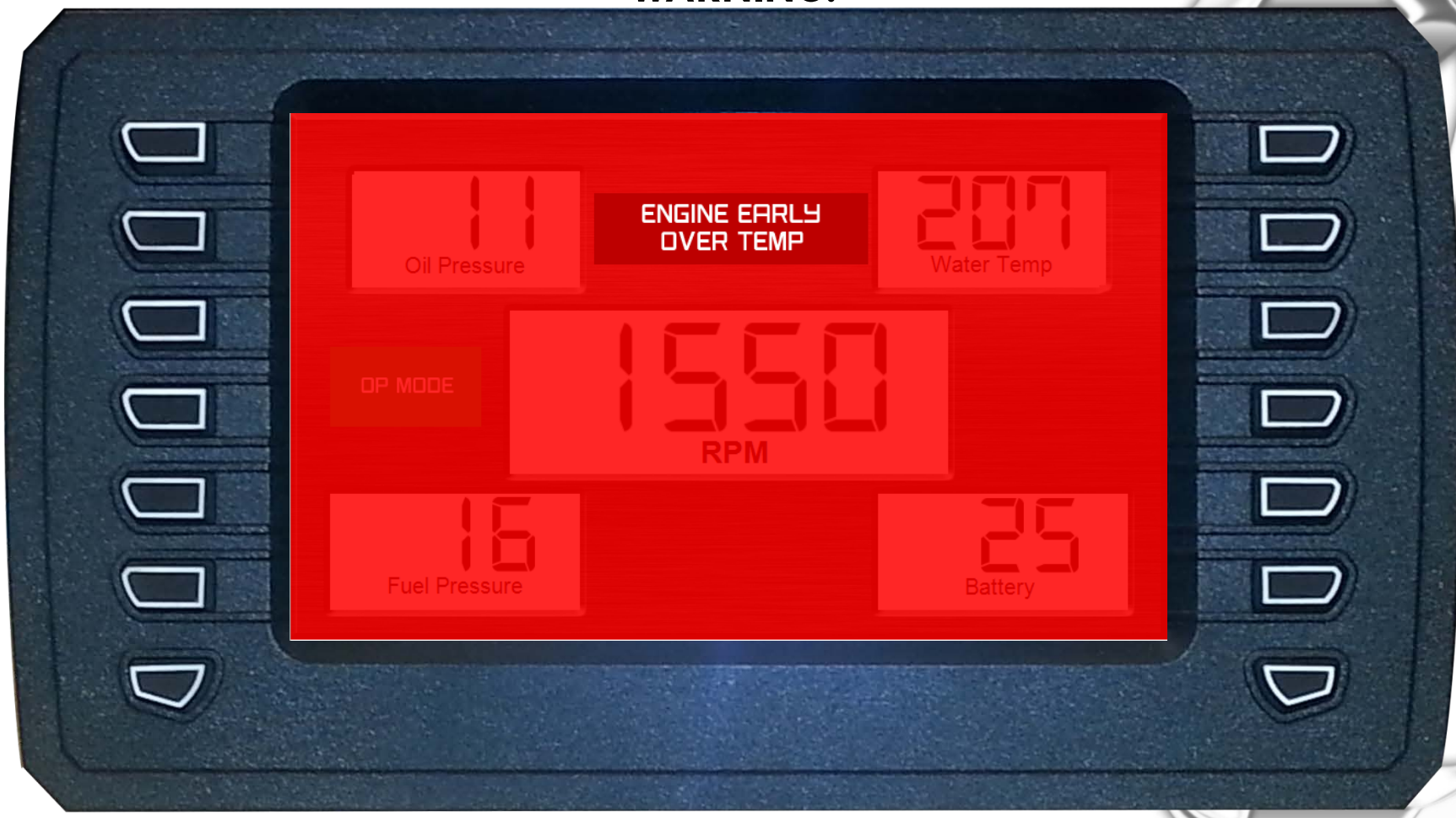
This Screen Flashes ever 2sec while the feed system is over pressure. (TUB)After 3.5sec the feed system will auto reverse for 2.5sec. Then go back forward. (DZH) After 2sec the feed will auto reverse for 1sec.

With the PLC in Bypass the feed system will turn in either direction at any RPM

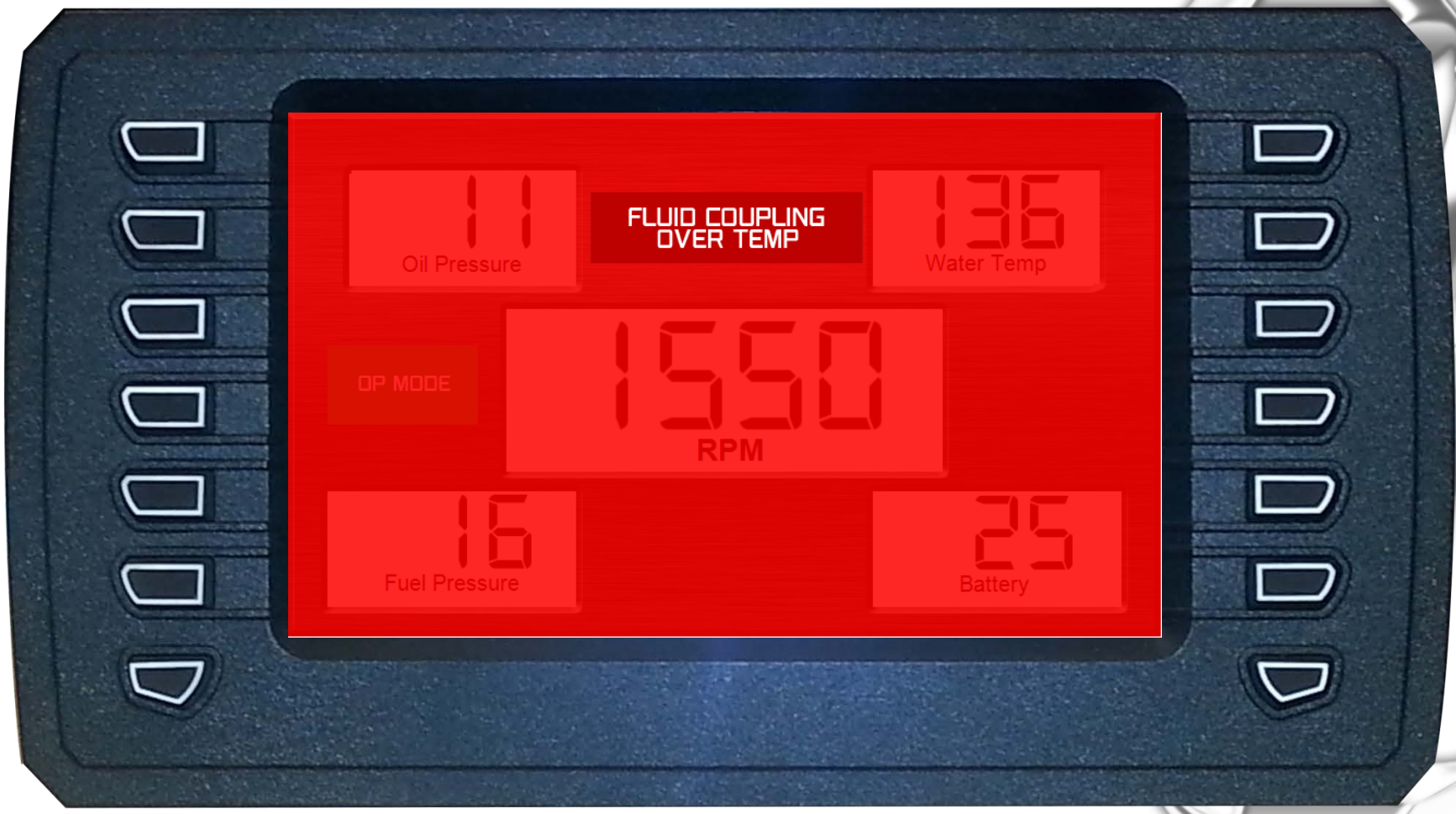
MILL COVER/CRUSH ROLLER OR TUB IS UNSECURED

THIS SCREEN FLASHES EVERY 2 SEC SHOWING EMERGENCY KILL HAS BEEN SET. RESET KILL SWITCH PRIOR TO ENGAGING THE START SWITCH.

THIS ANALOG GAUGE FLASHES EVERY 2 SEC FOR ENGINE EARLY OVER TEMP WARNING IF ENGINE EXCEEDS 220*. THIS IS ONLY A WARNING!

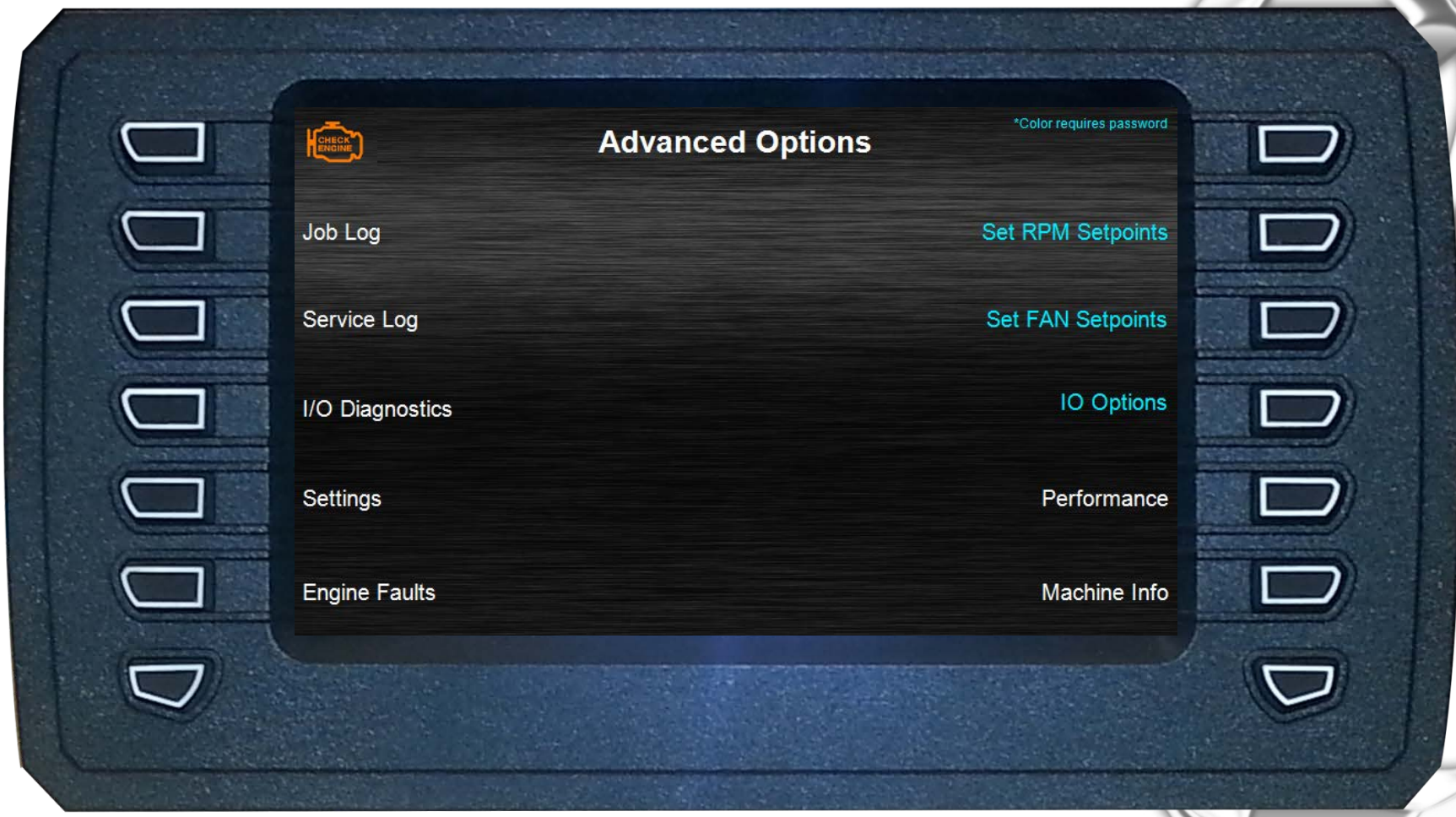


DIGITAL SCREEN WILL FLASH RED EVERY 2 SEC. WHEN THE FLUID COUPLER TEMP EXCEEDS180*F. THIS WILL SHUT OFF THE FLUID COUPLER AND IDLE THE ENGINE DOWN.



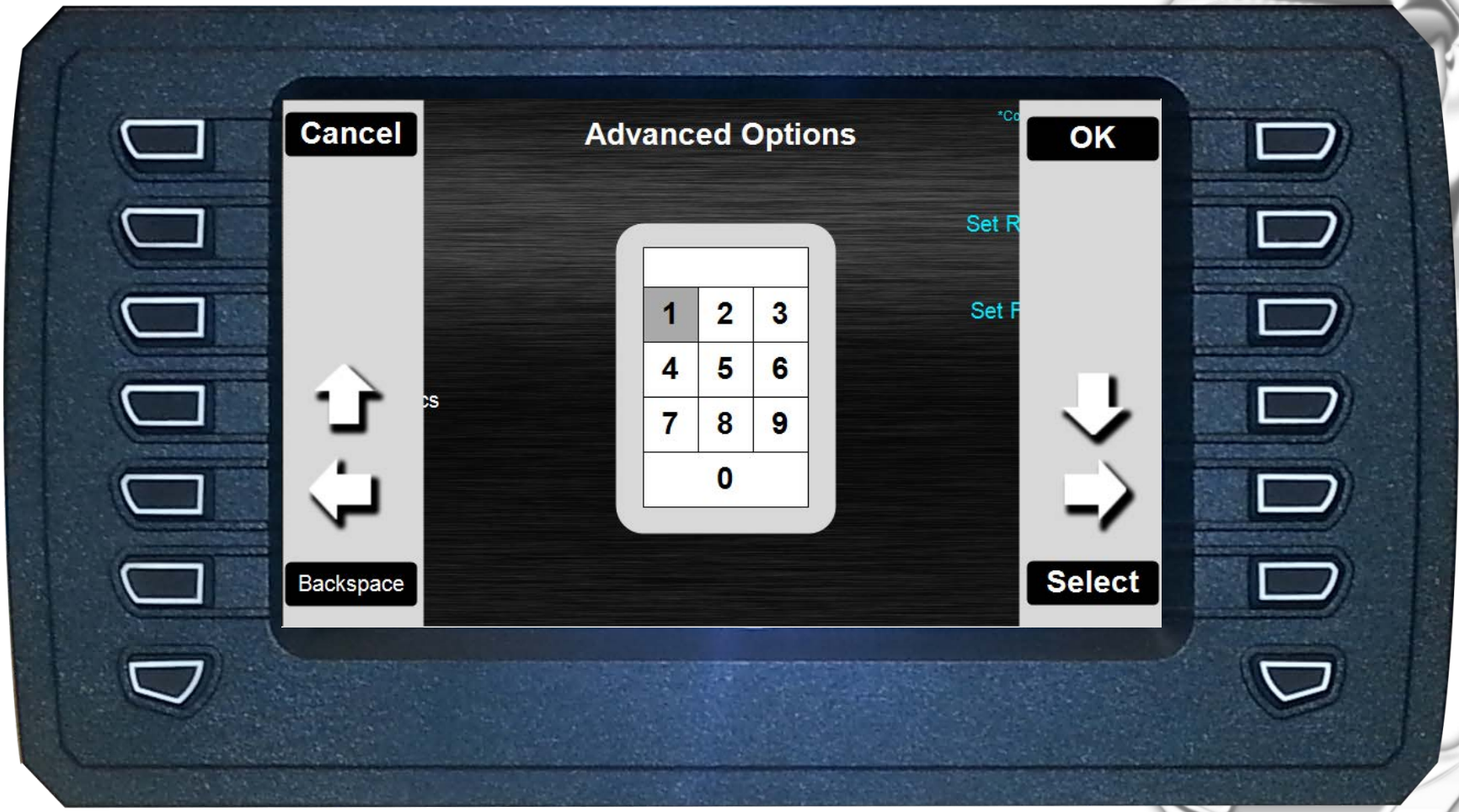
ADVANCE OPTIONS SCREEN

ADVANCED OPTIONS SCREEN



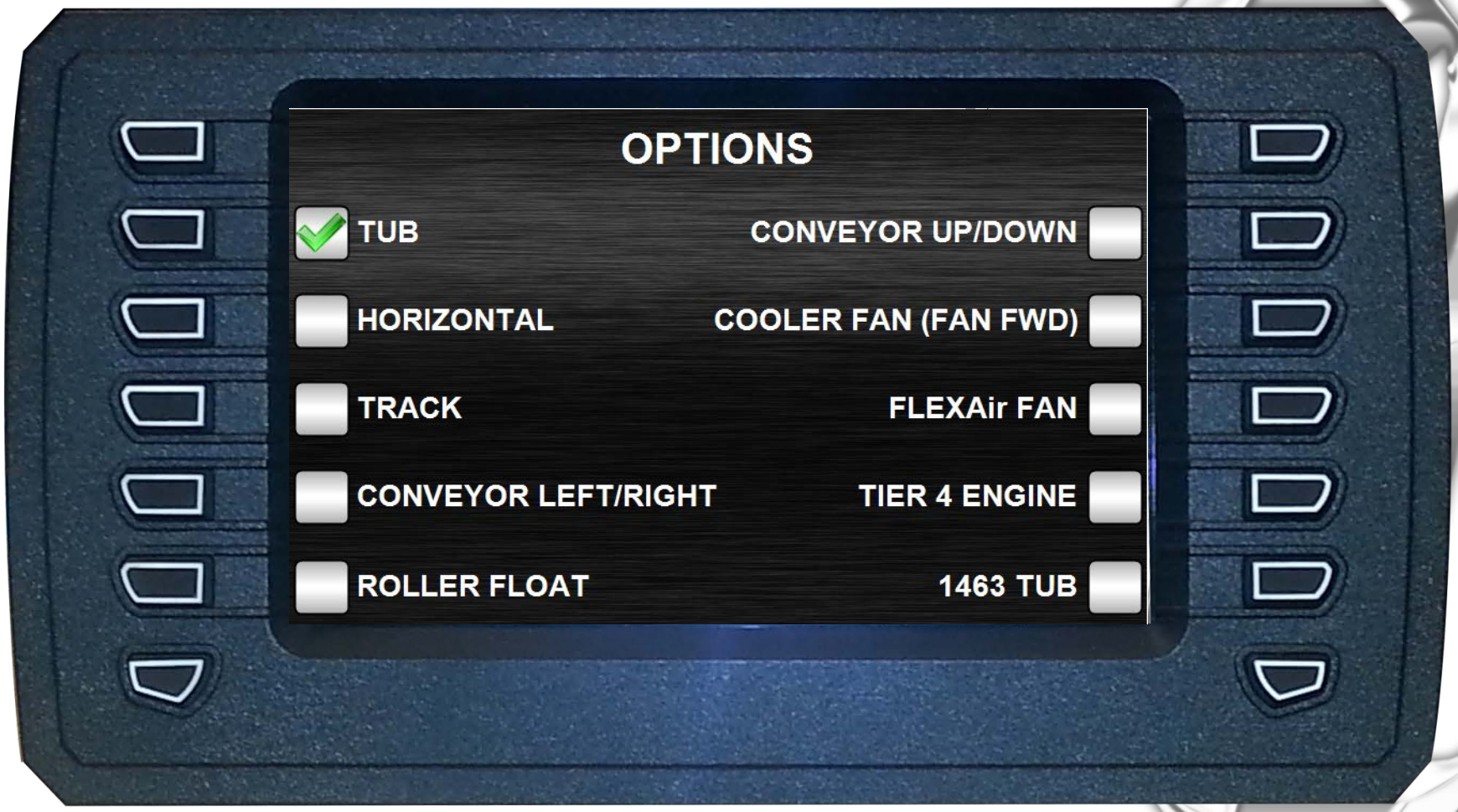
Advanced options screen is how to check engine fault code, service log, IO diagnostic inputs & outputs, machine setting, setting the RPM set points, setting the fan purge set points, machine performance

ADVANCED OPTIONS SCREEN PASS WORD PROTECTED



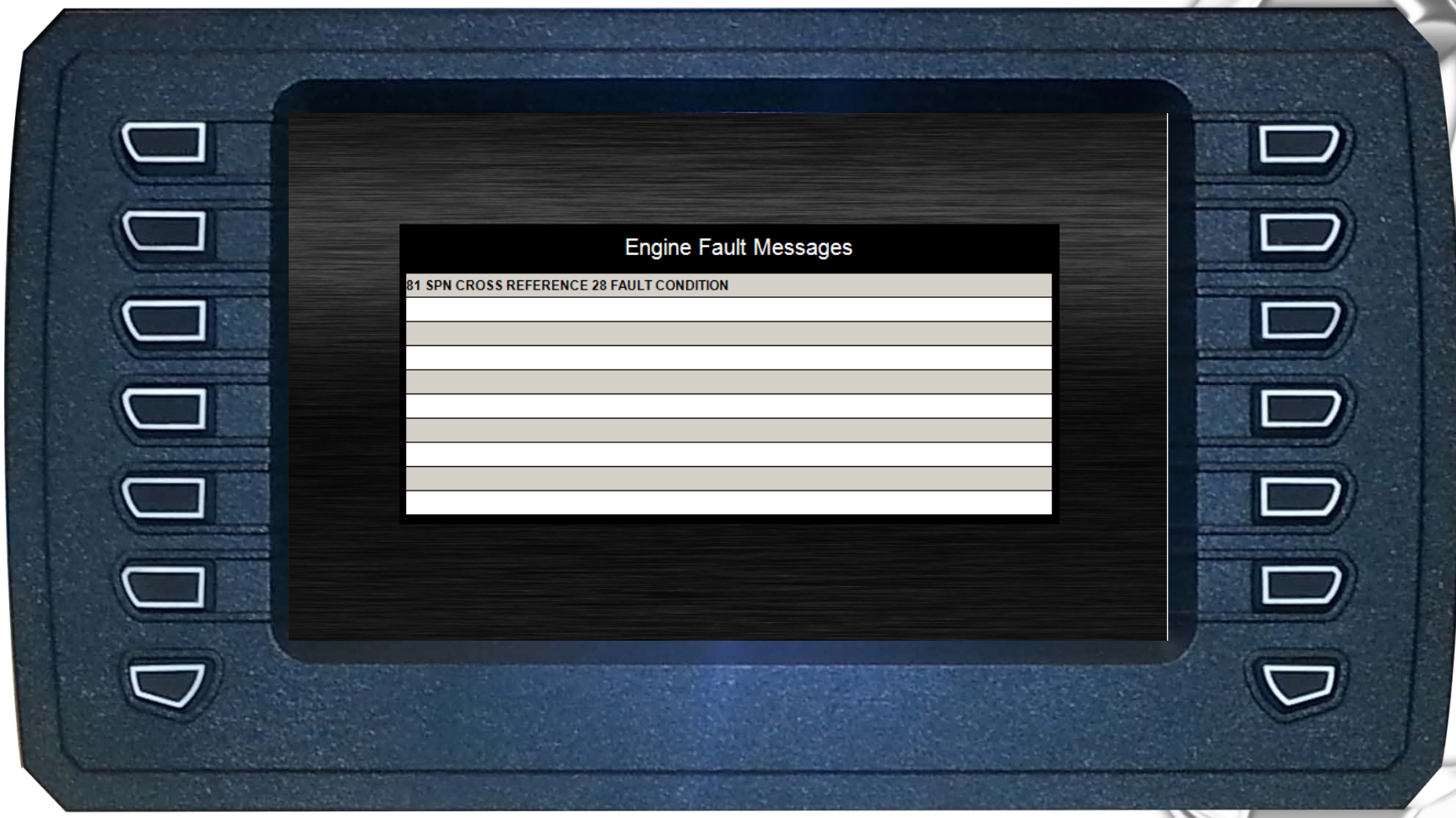
Blue topics can be accessed by entering customer code 1,2,3,4,

PLC PROGRAM MODE SCREEN. THIS SCREEN IS ONLY ACCESS WITH A FACTORY PRE SET PASSWORD



This set up screen allows you to configure your plc for any Rule Steel/Diamond Z product without the necessity of having to reprogram or inventory multiple plc's.

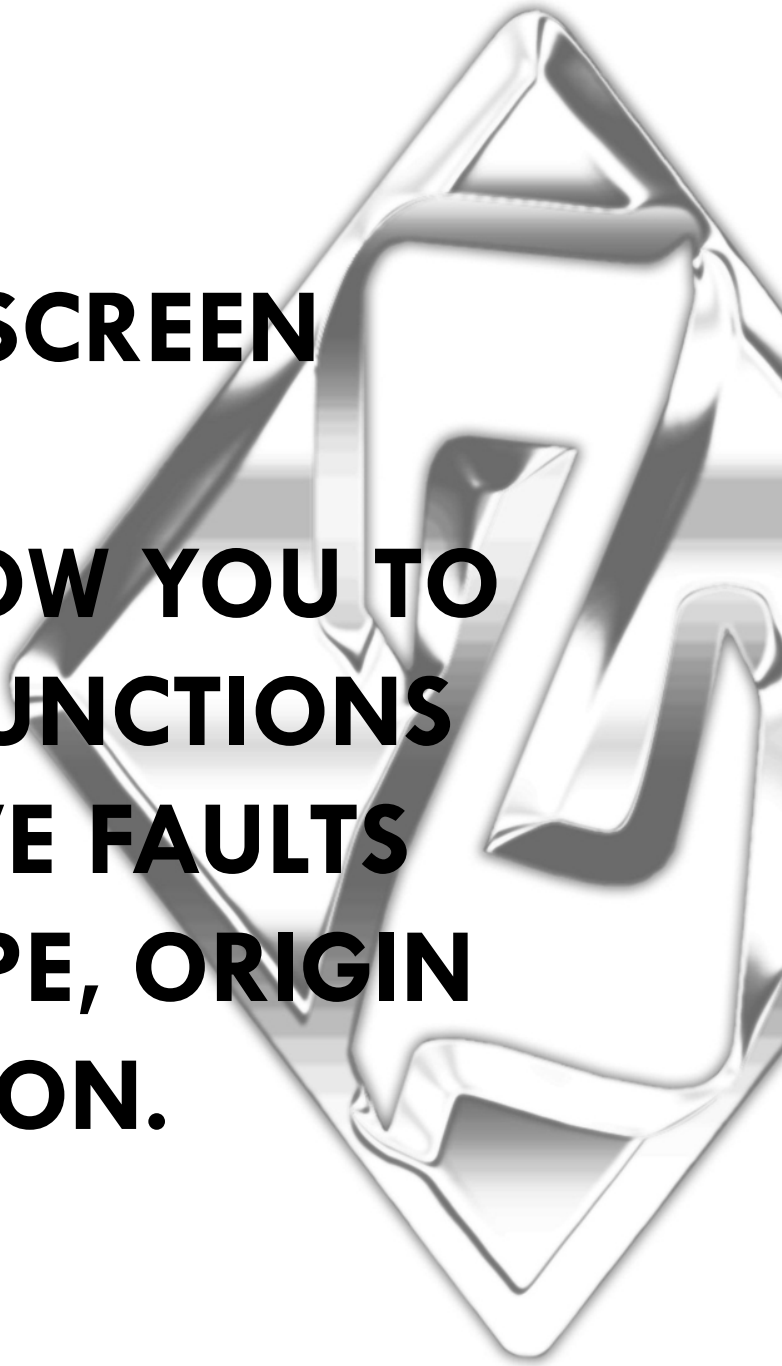
Engine Fault Code Screen



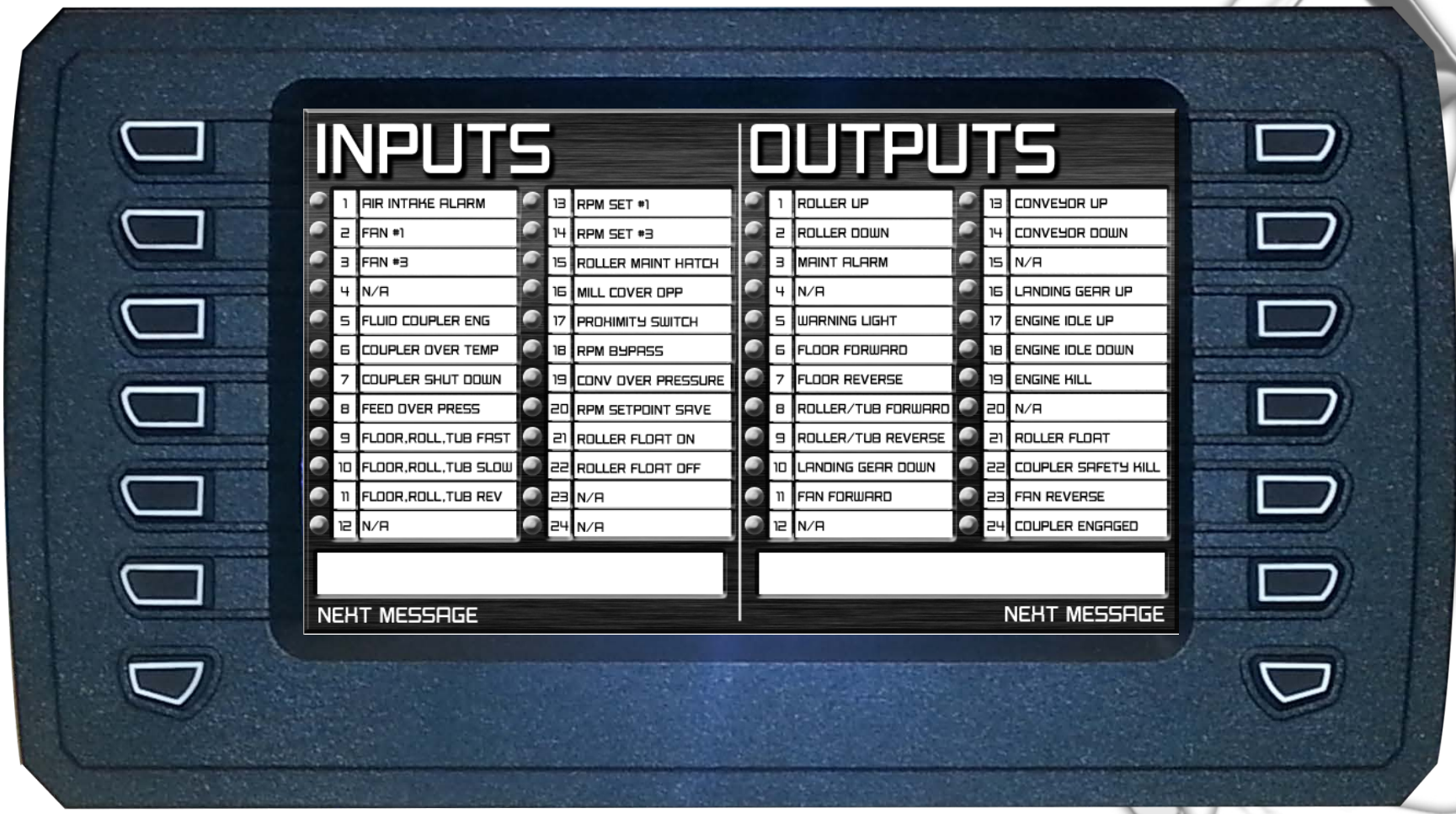
This screen will show all active engine fault codes

SELF DIAGNOSTIC SCREEN

THIS SCREEN WILL ALLOW YOU TO SEE ALL PLC ACTIVE FUNCTIONS AND POSSIBLE ACTIVE FAULTS INDICATING WHAT TYPE, ORIGIN AND DESTINATION.

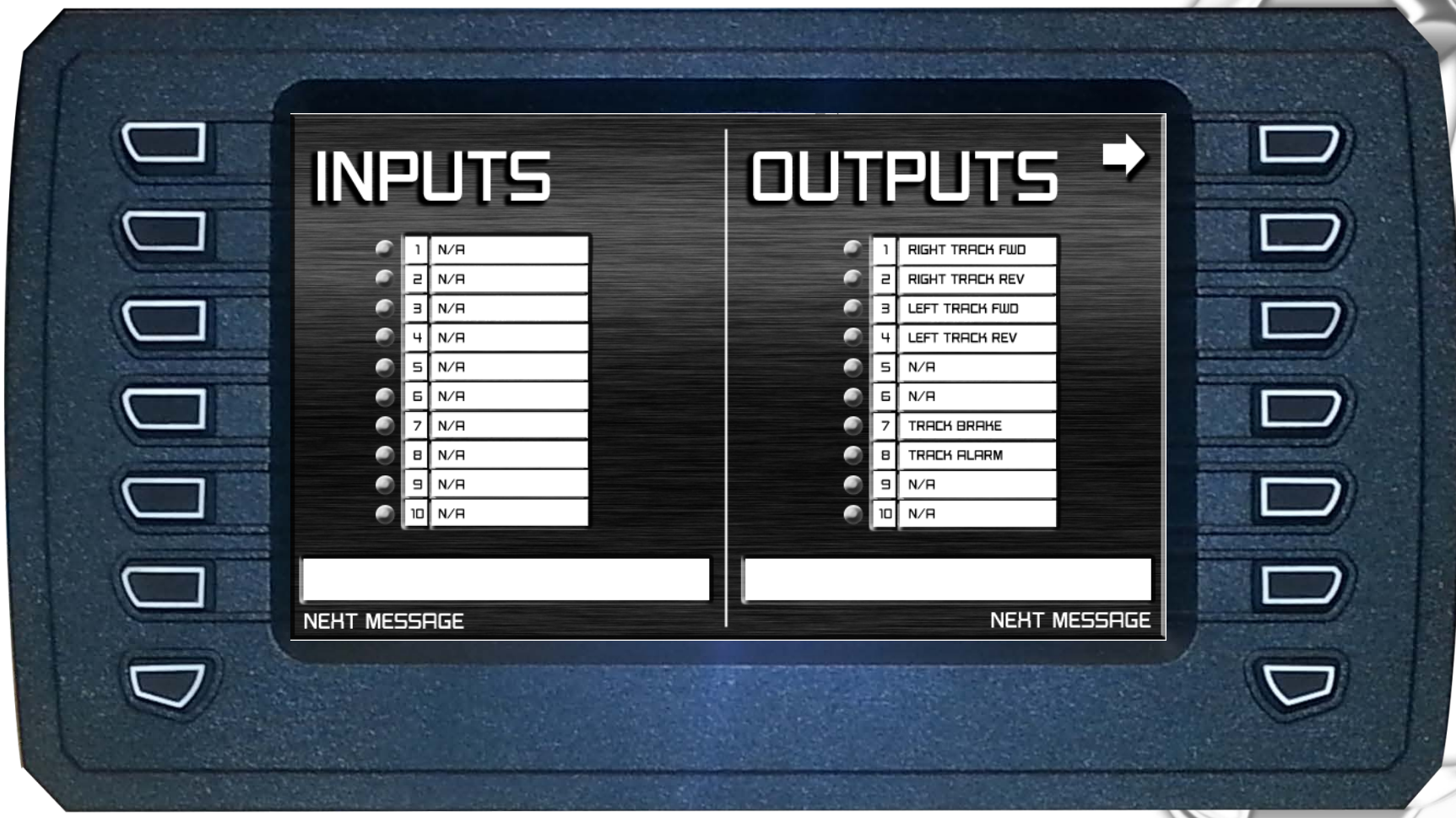


I/O Screen



This Input/Output screen is reached by selecting I/O diagnostics screen in the advanced options screen. With normal functionality when a sensor input is activated the corresponding light will lite green. If there is abnormal activity such as a dead short or over amp situation it will show yellow and scroll the fault code below.

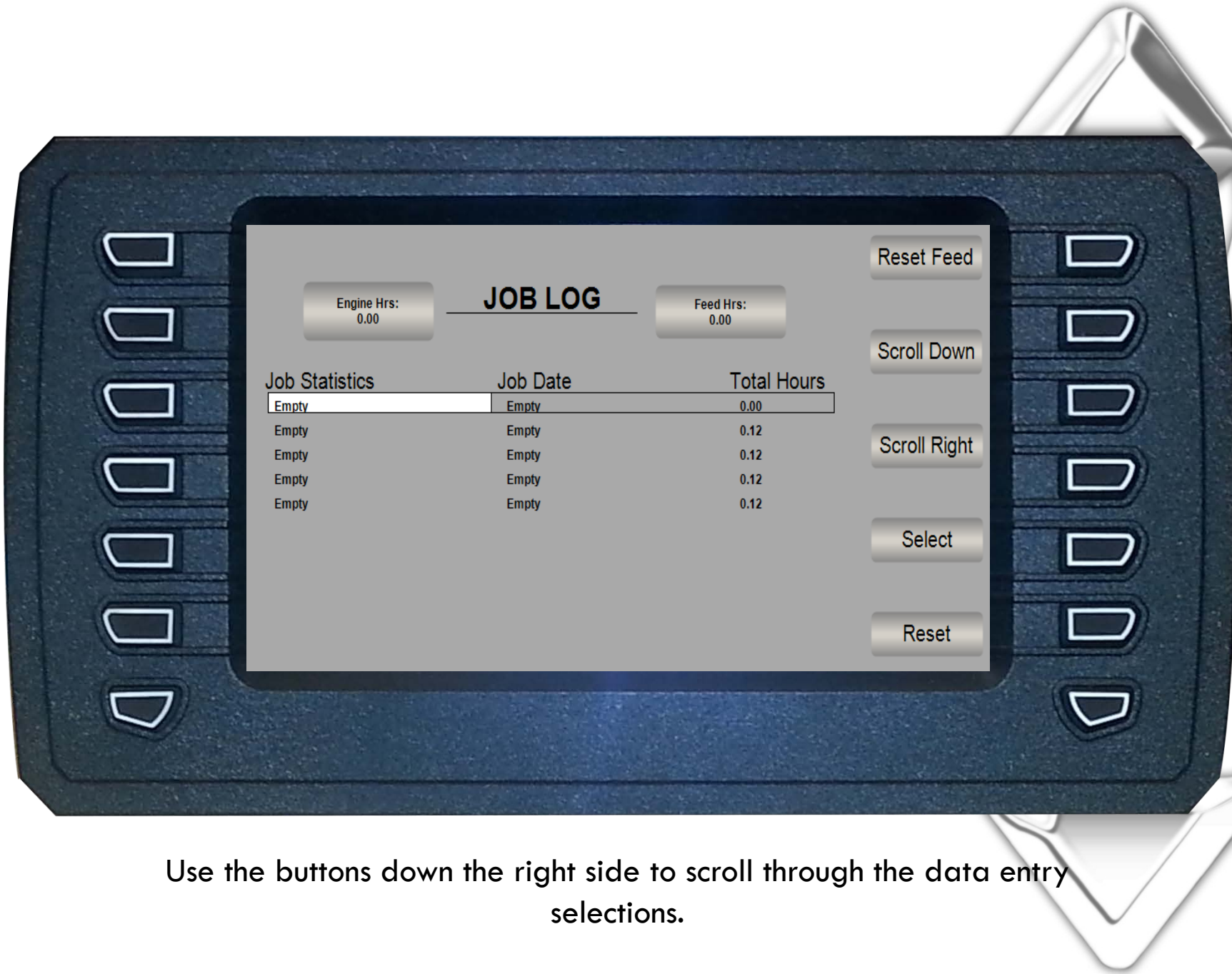
EXPANSION I/O SCREEN FOR TRACK MOUNTED UNITS



Any active faults can be reset by turning off battery disconnect key for 30 seconds

JOB LOG SCREEN

YOU CAN STORE JOB STATISTICS, DATE, RUN TIME



Use the buttons down the right side to scroll through the data entry selections.

ENGINE PERFORMANCE SCREEN

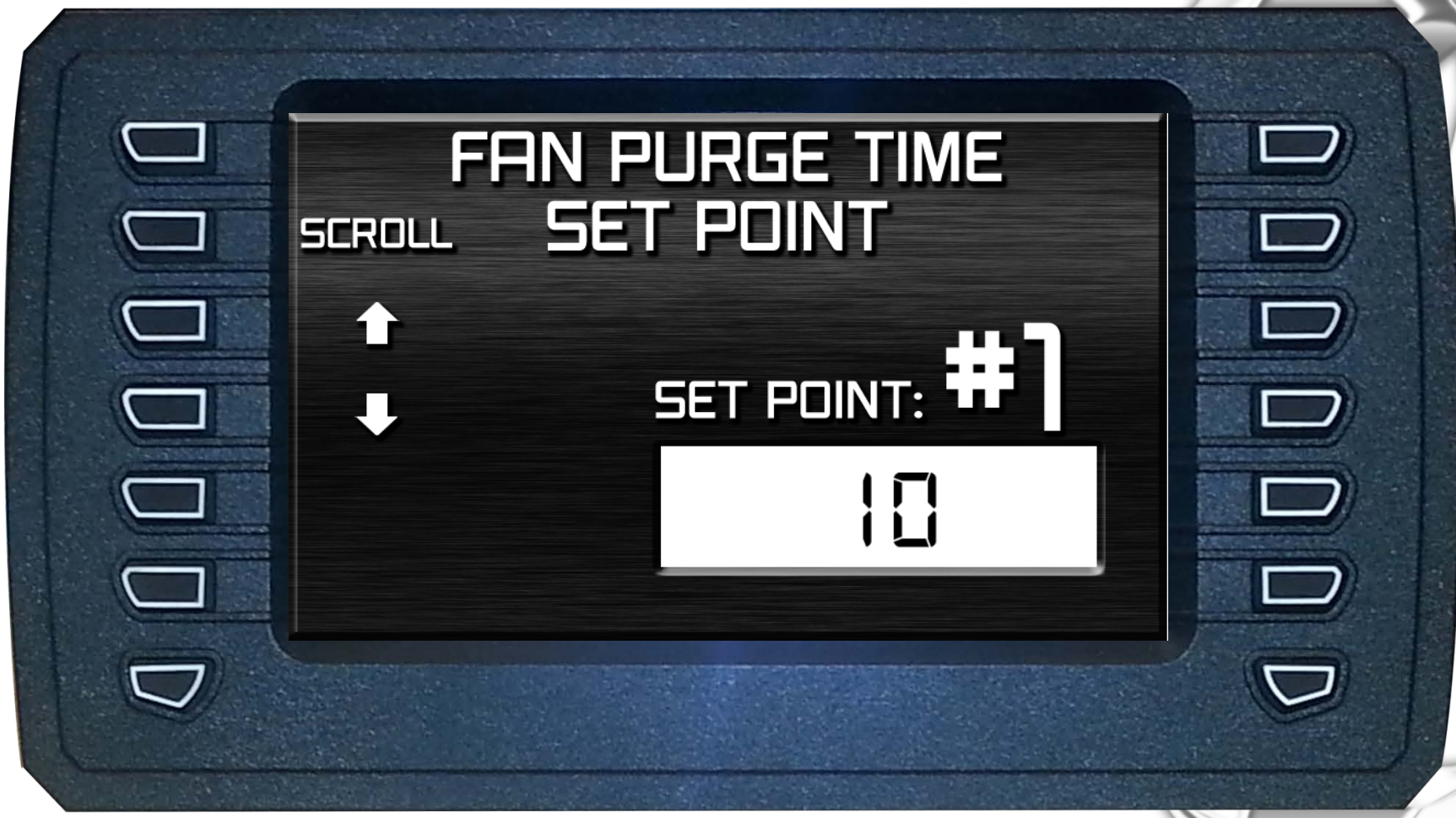
Here you can see all engine data real time simultaneously

FAN PURGE CONTROL SCREENS

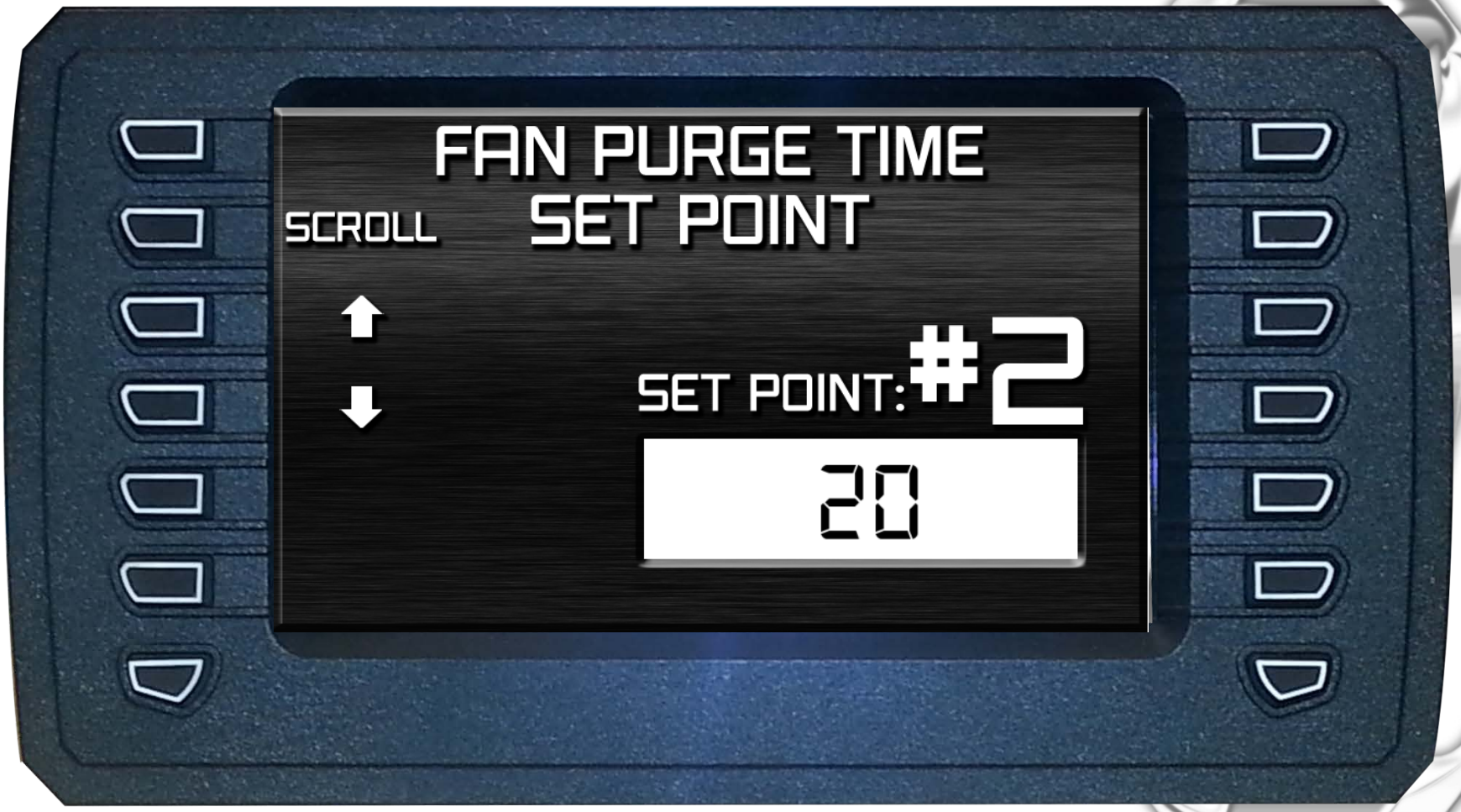
DIGITAL SCREEN WILL FLASH BLUE EVERY 2 SECONDS WHILE THE FAN IS IN A PURGE CYCLE

Fan auto purge set at 200*.
Plc will only allow one purge cycle every five Minutes to prevent over heating

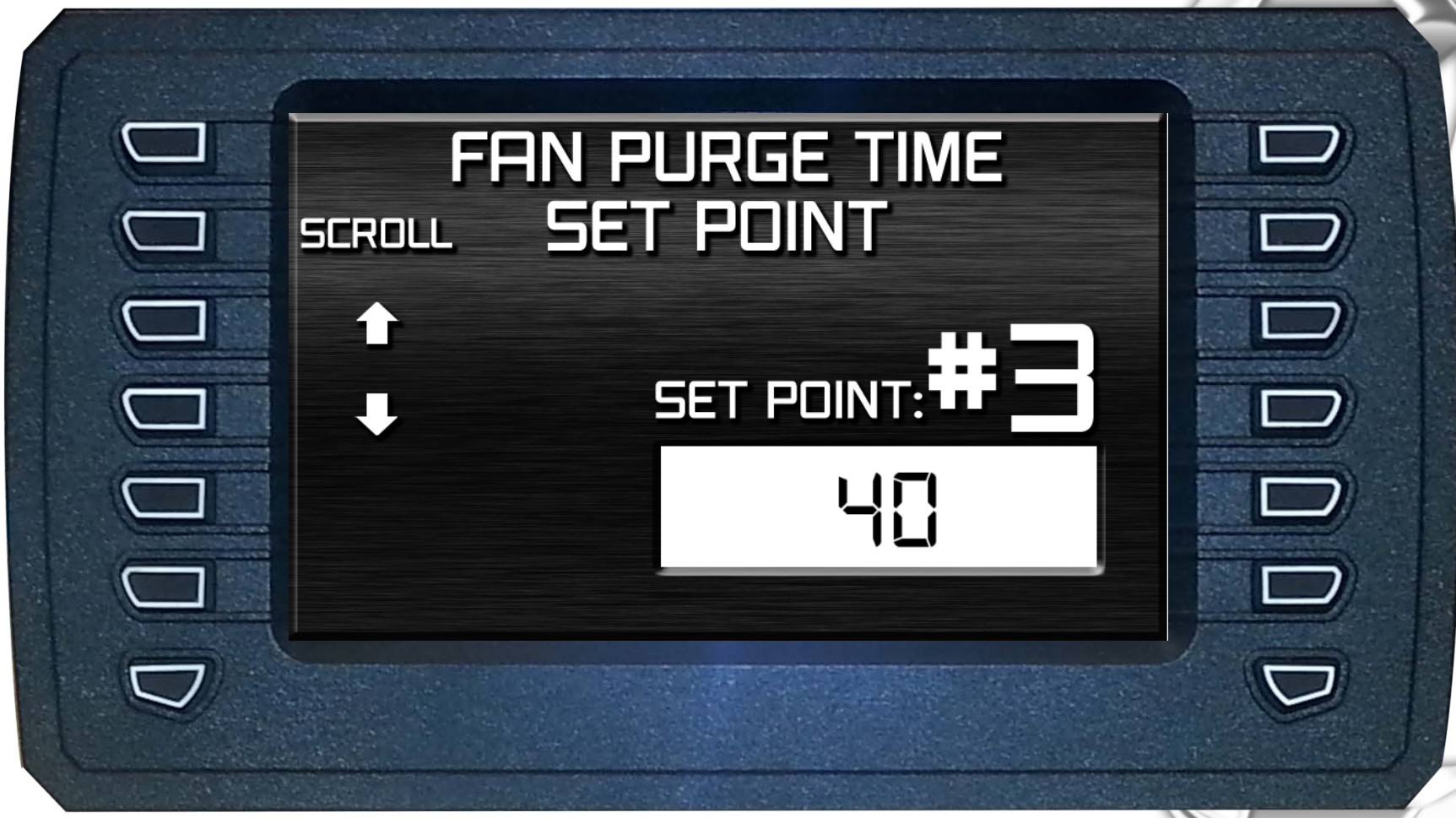
FAN PURGE SET POINT ONE = 10 MINUTES
FOR EXTREMELY DRY OR DUSTY CONDITIONS.



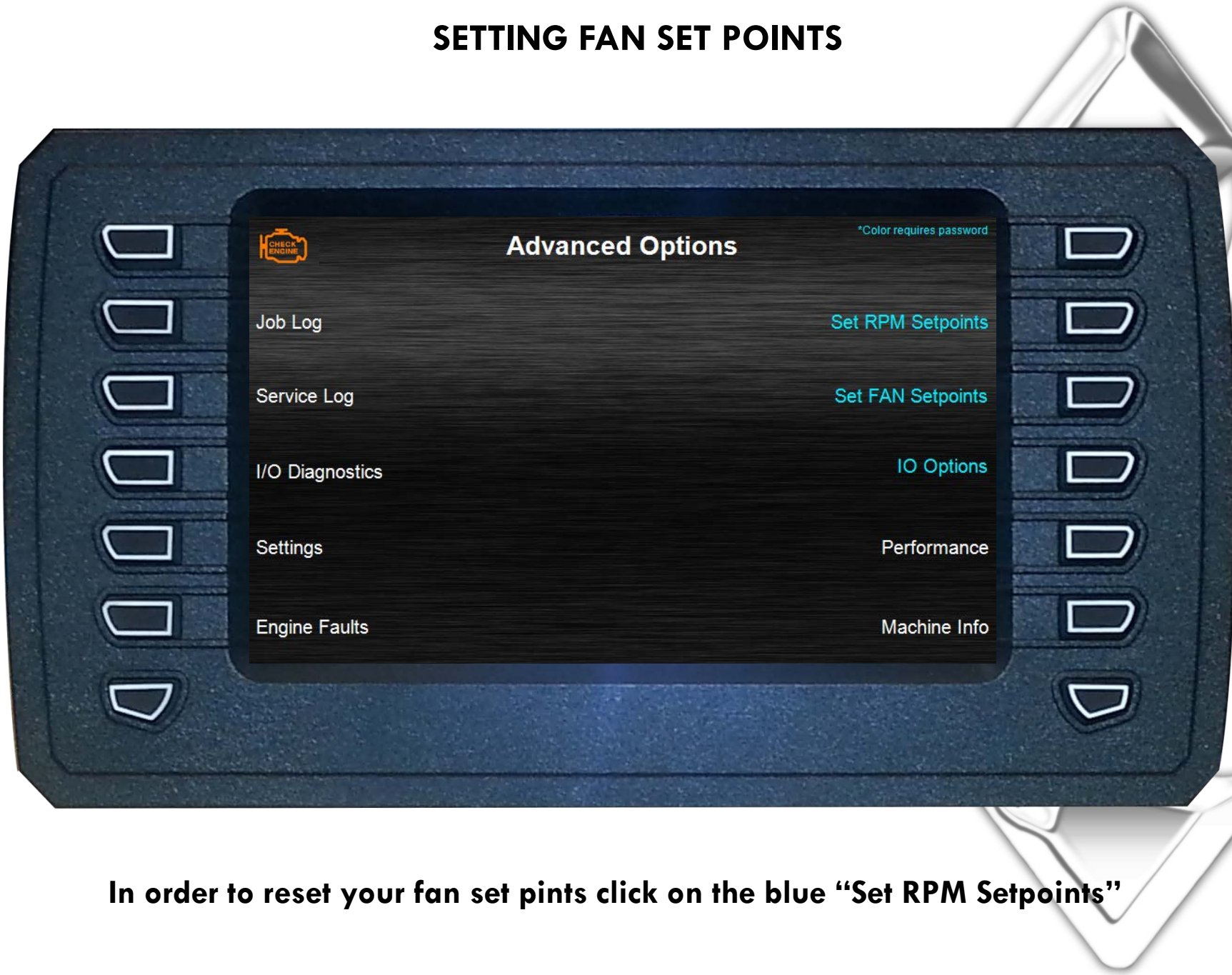
Fan purge set point TWO = 20 minutes
For normal conditions.



Fan purge time set point Three = 40 minutes
For cooler conditions and where debris in the minimal

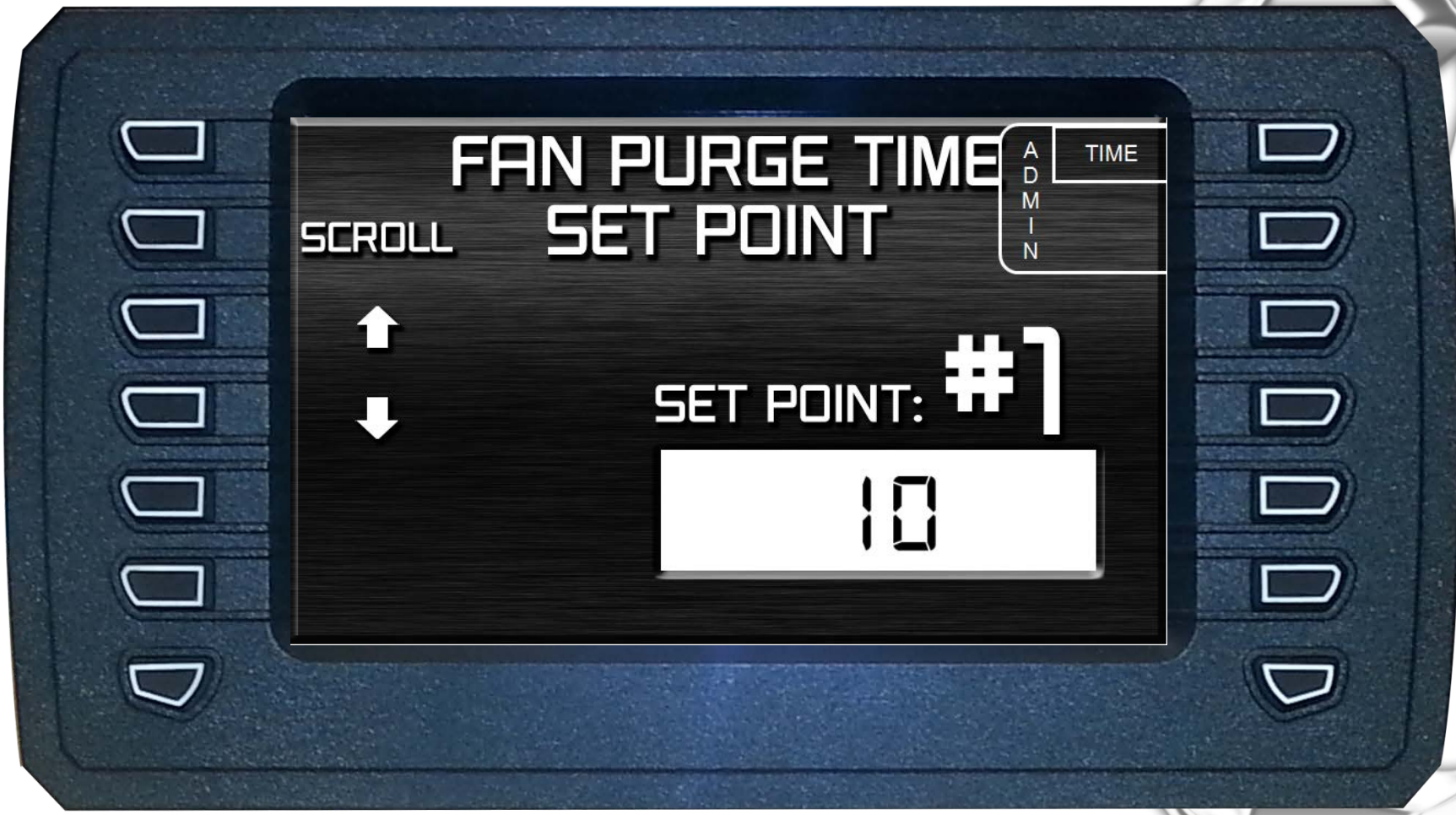


SETTING FAN SET POINTS

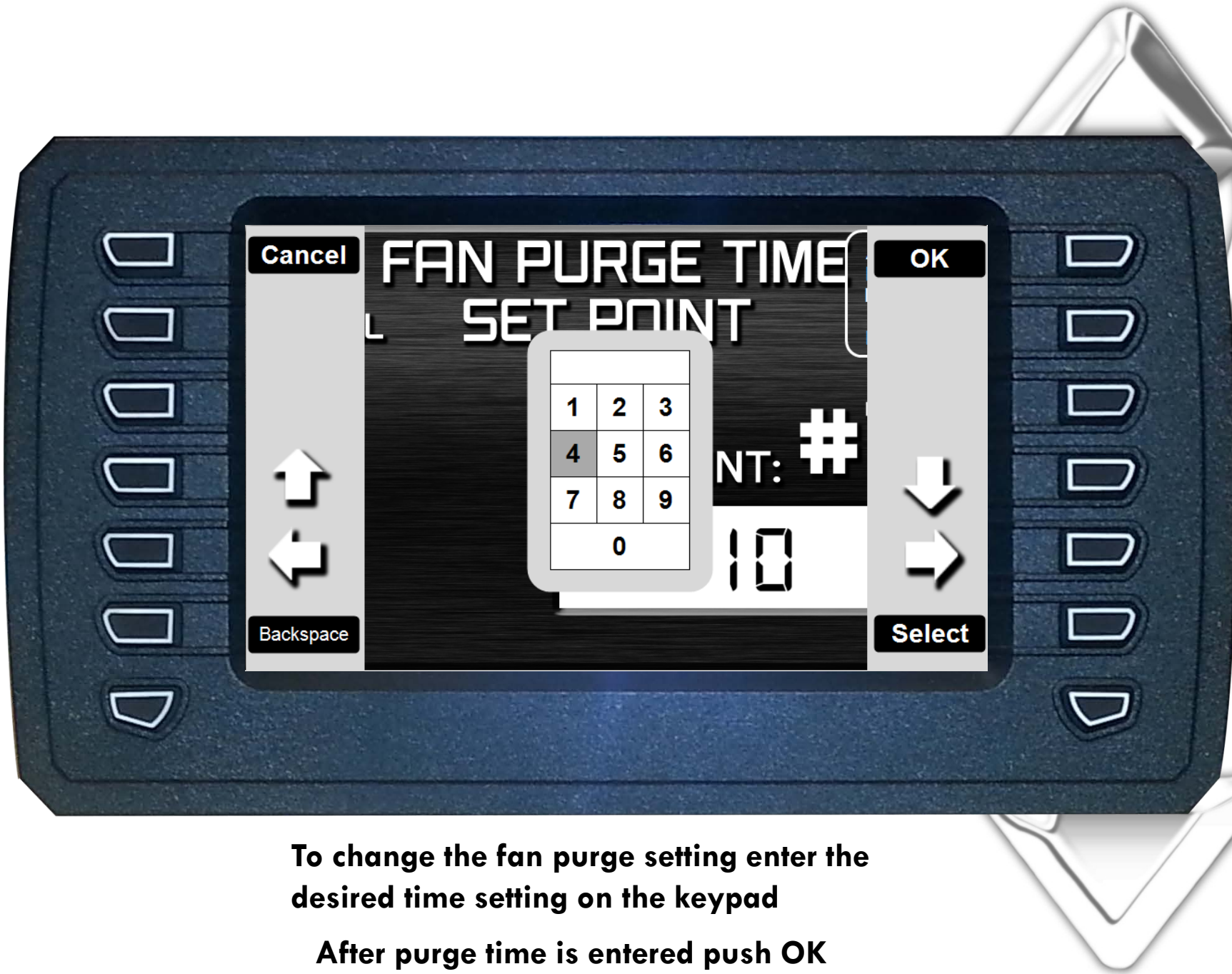


In order to reset your fan set pints click on the blue “Set RPM Setpoints”

FAN PURGE TIME SETTINGS CAN BE RE PROGRAMED



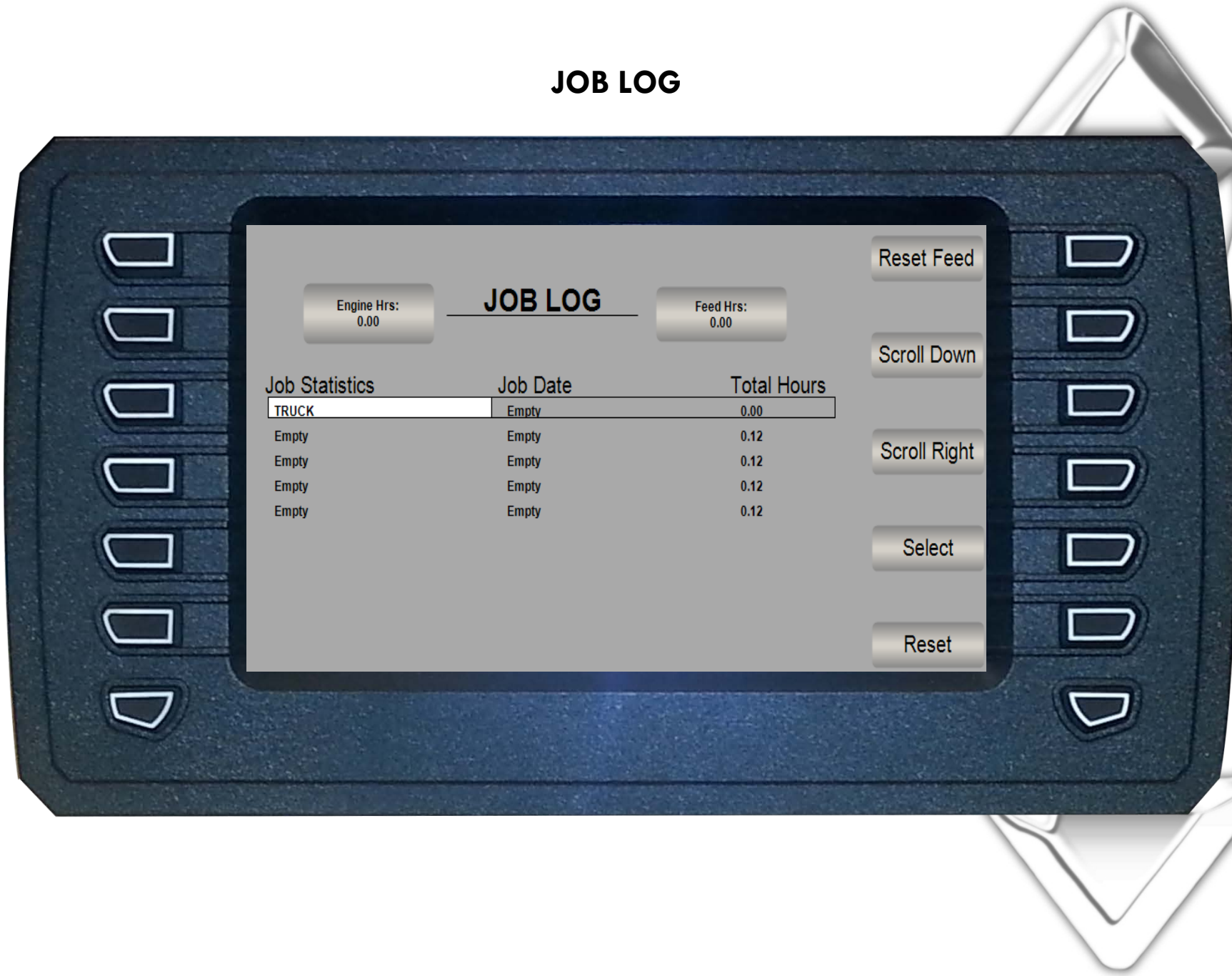
To go to the Fan Purge time setting screen scroll up or down: To change the setting time push admin button this will take you to next screen



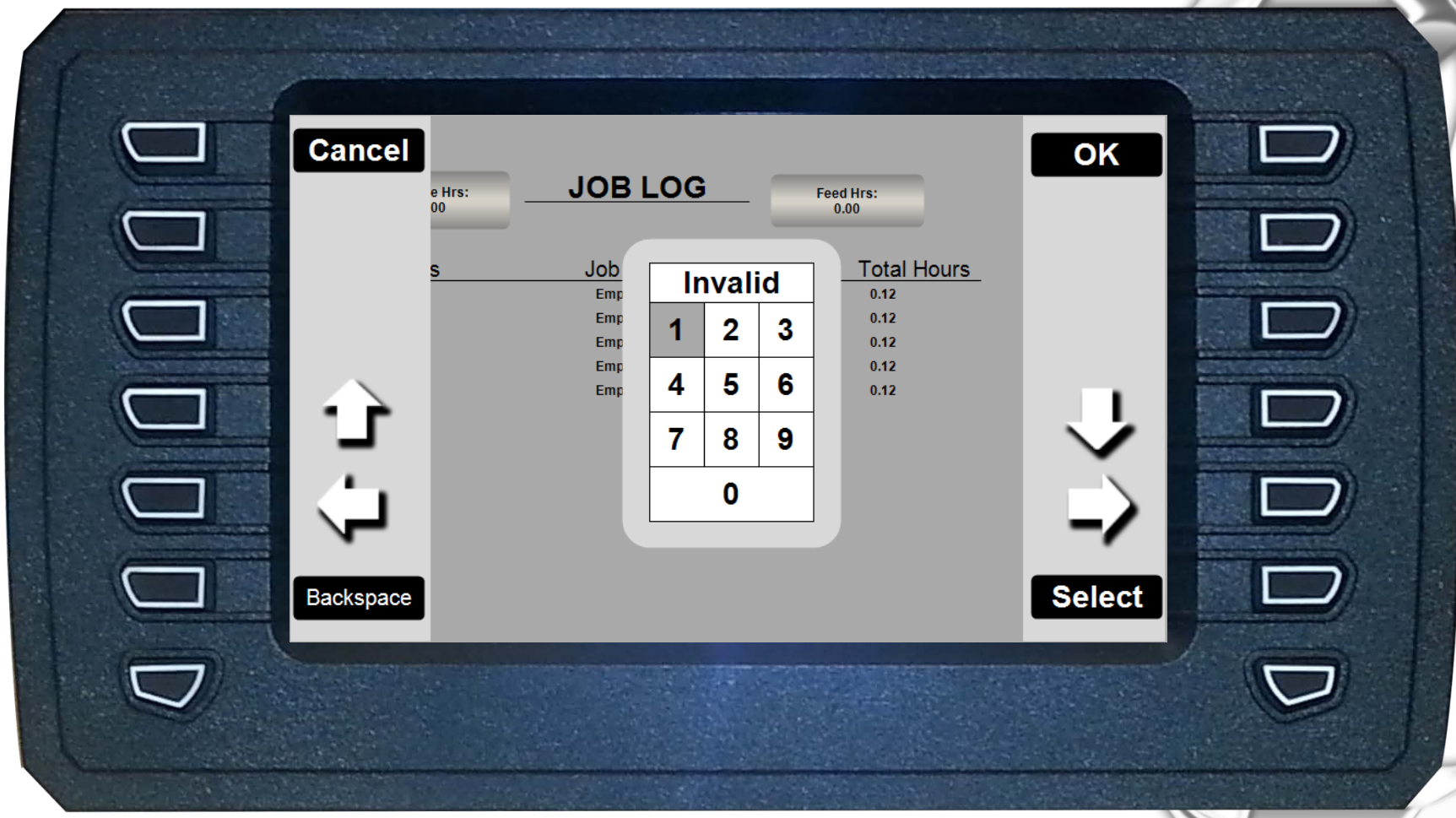
To change the fan purge setting enter the desired time setting on the keypad

After purge time is entered push OK

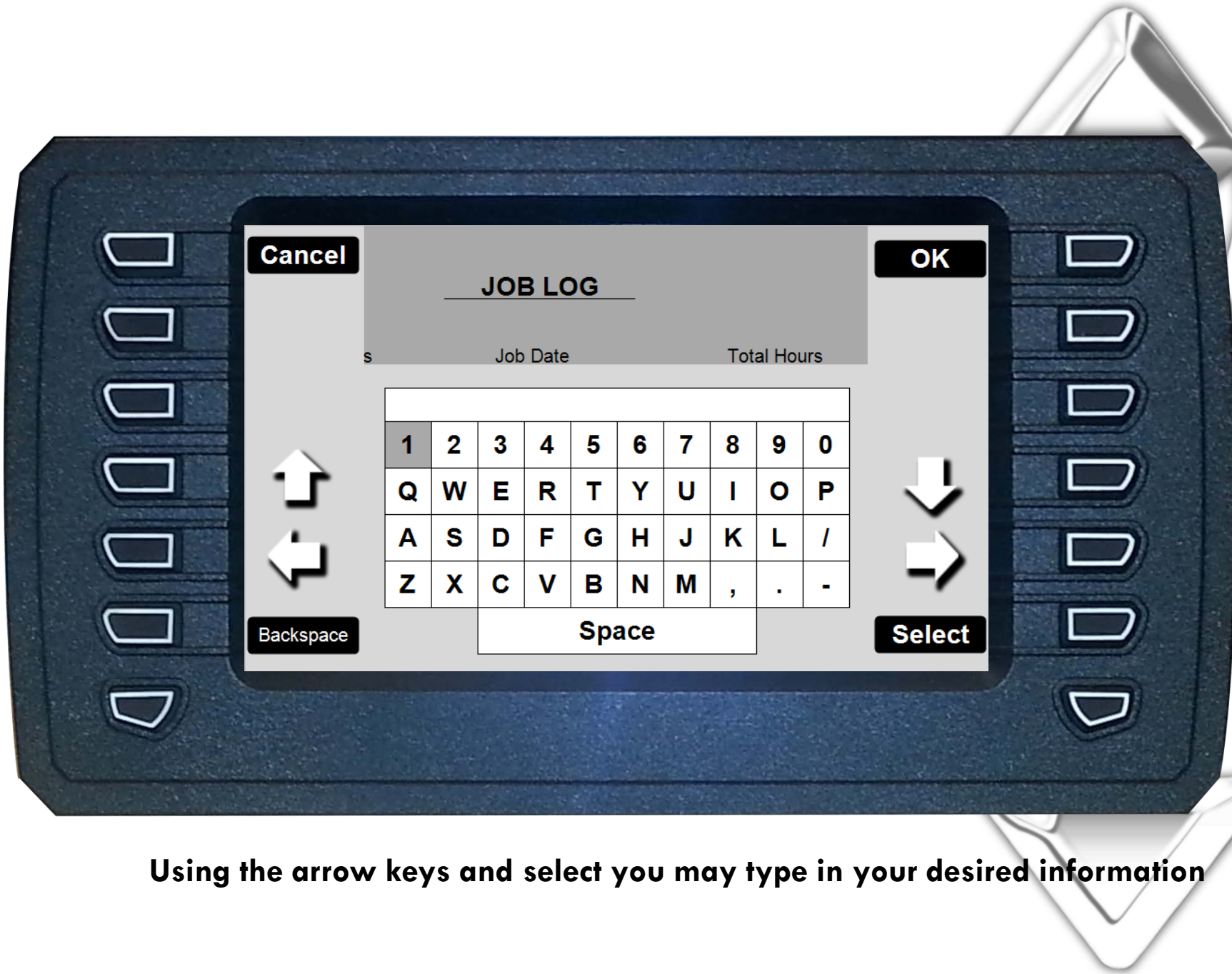
JOB LOG


Reset Feed
Engine Hrs:
0.00
JOB LOG
Feed Hrs:
0.00
Scroll Down
Job Statistics
Job Date
Total Hours
TRUCK
Empty
0.00
Empty
Empty
0.12
Empty
Empty
0.12
Empty
Empty
0.12
Empty
Empty
0.12
Scroll Right
Select
Reset

JOB LOG DATA CAN BE PROGRAMED

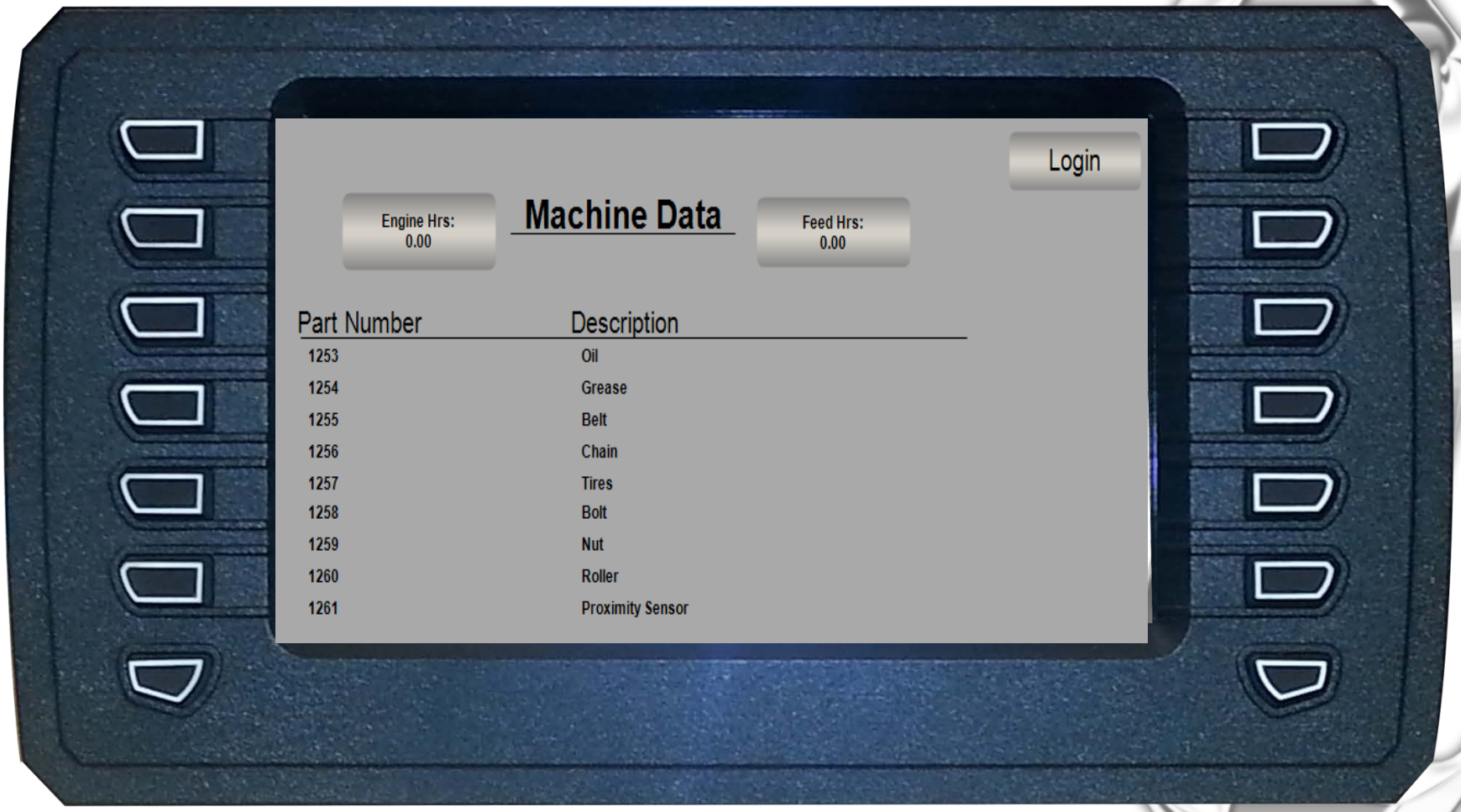


Password protection allows for individuals of your choosing to access this screen. Code 1,2,3,4

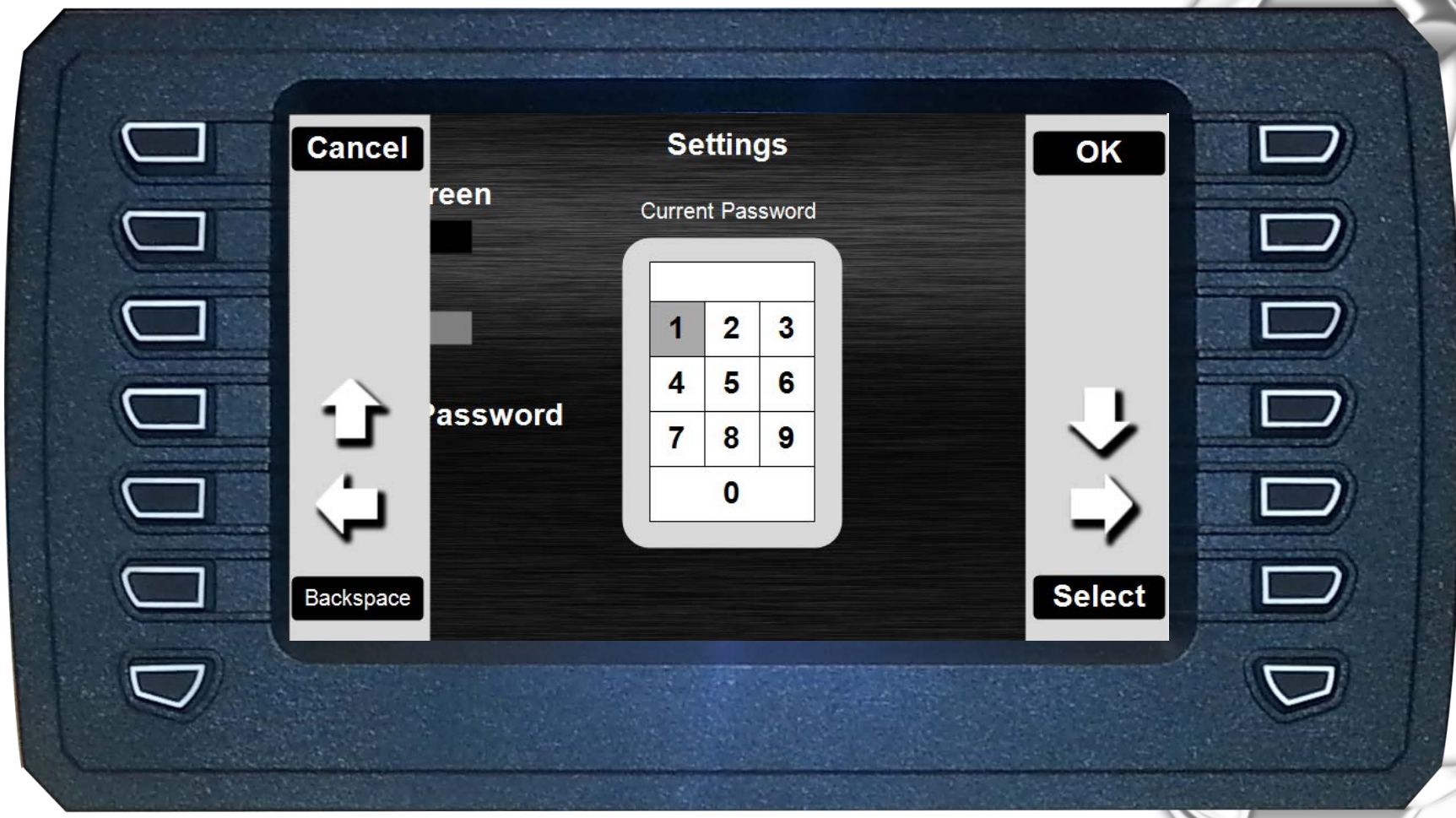


Using the arrow keys and select you may type in your desired information

MACHINE DATA SCREEN

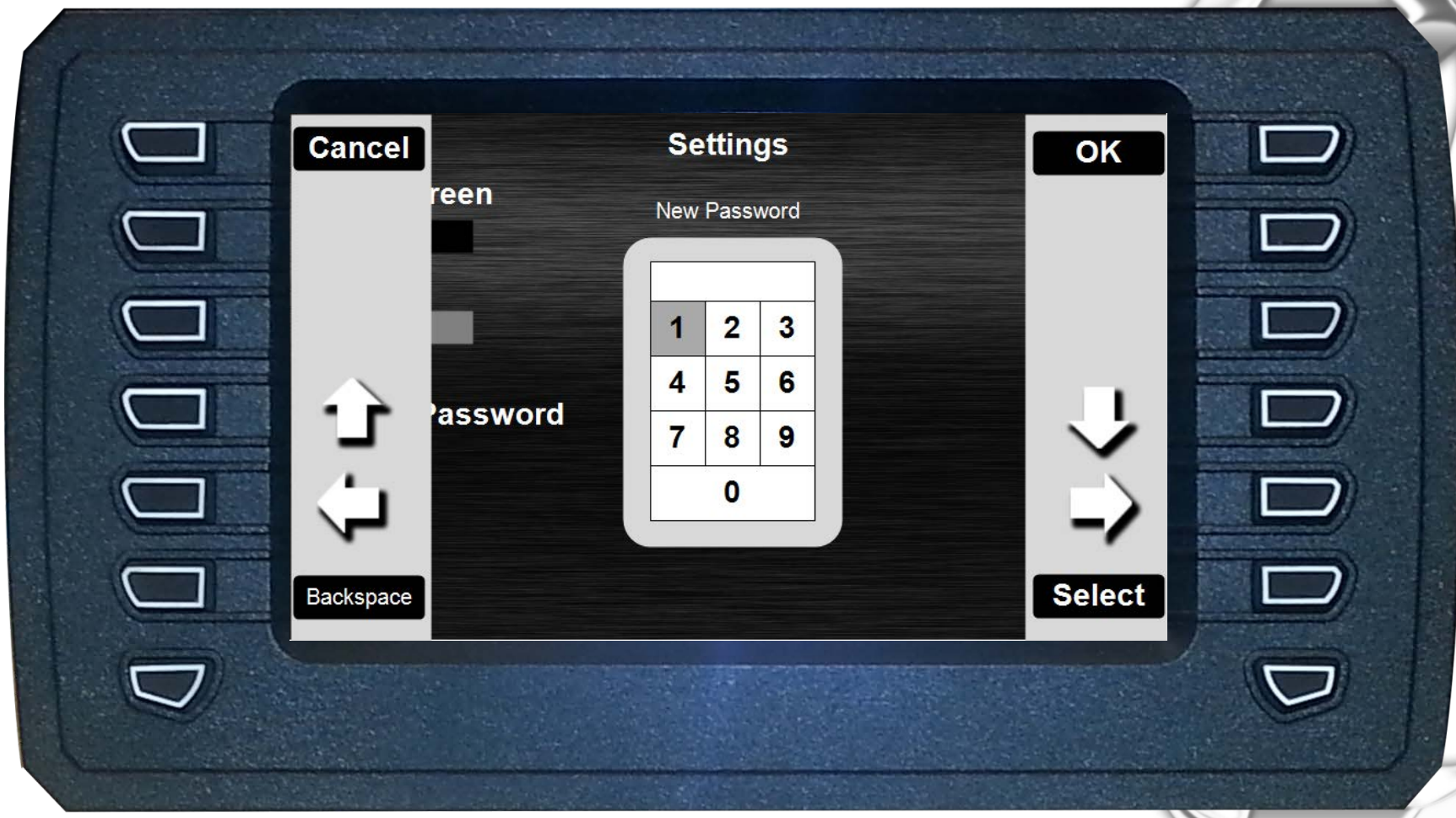


You can store specific machine data such Belt length, filter part numbers, air filters etc.



Enter the default password (1,2,3,4) to access the "change password screen". Enter minimum of 4 characters.

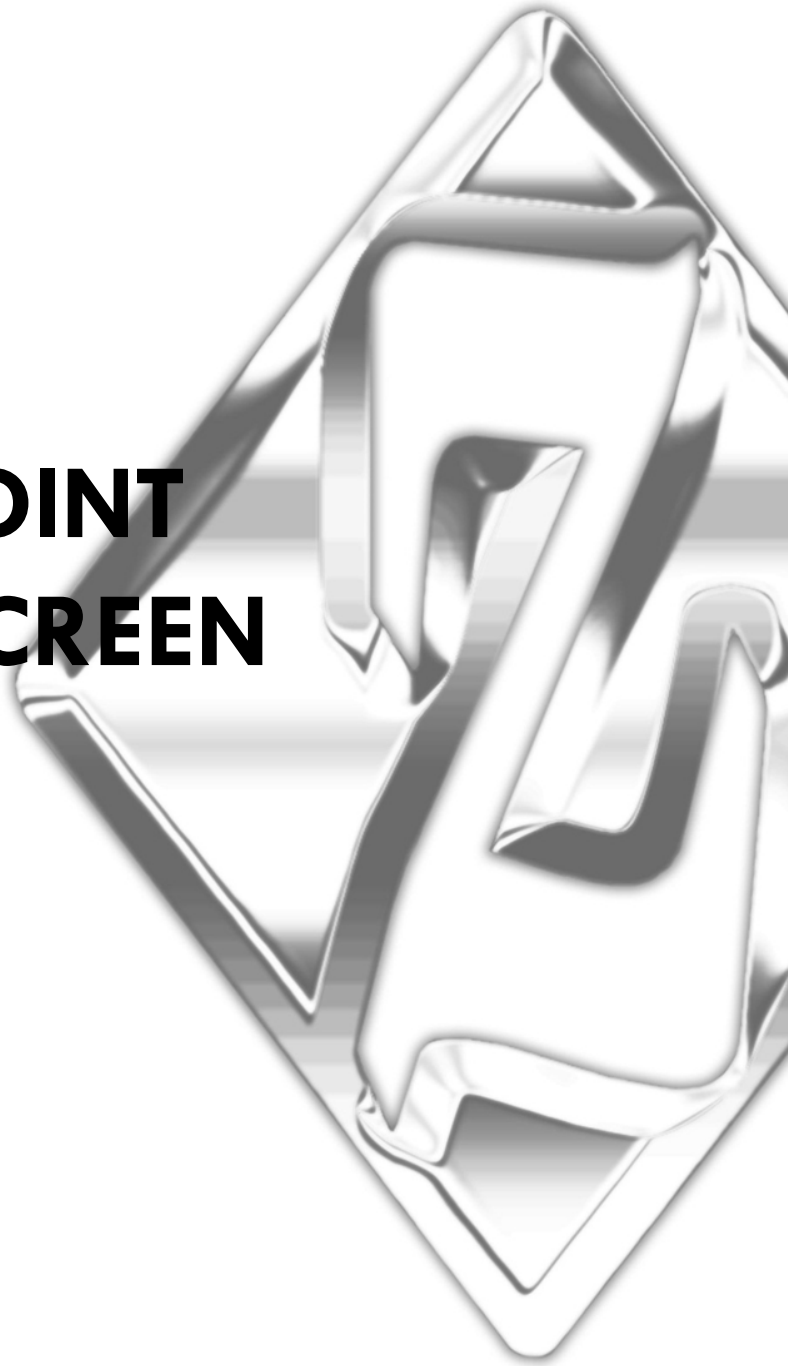
CUSTOMER PASSWORD CHANGE SCREEN



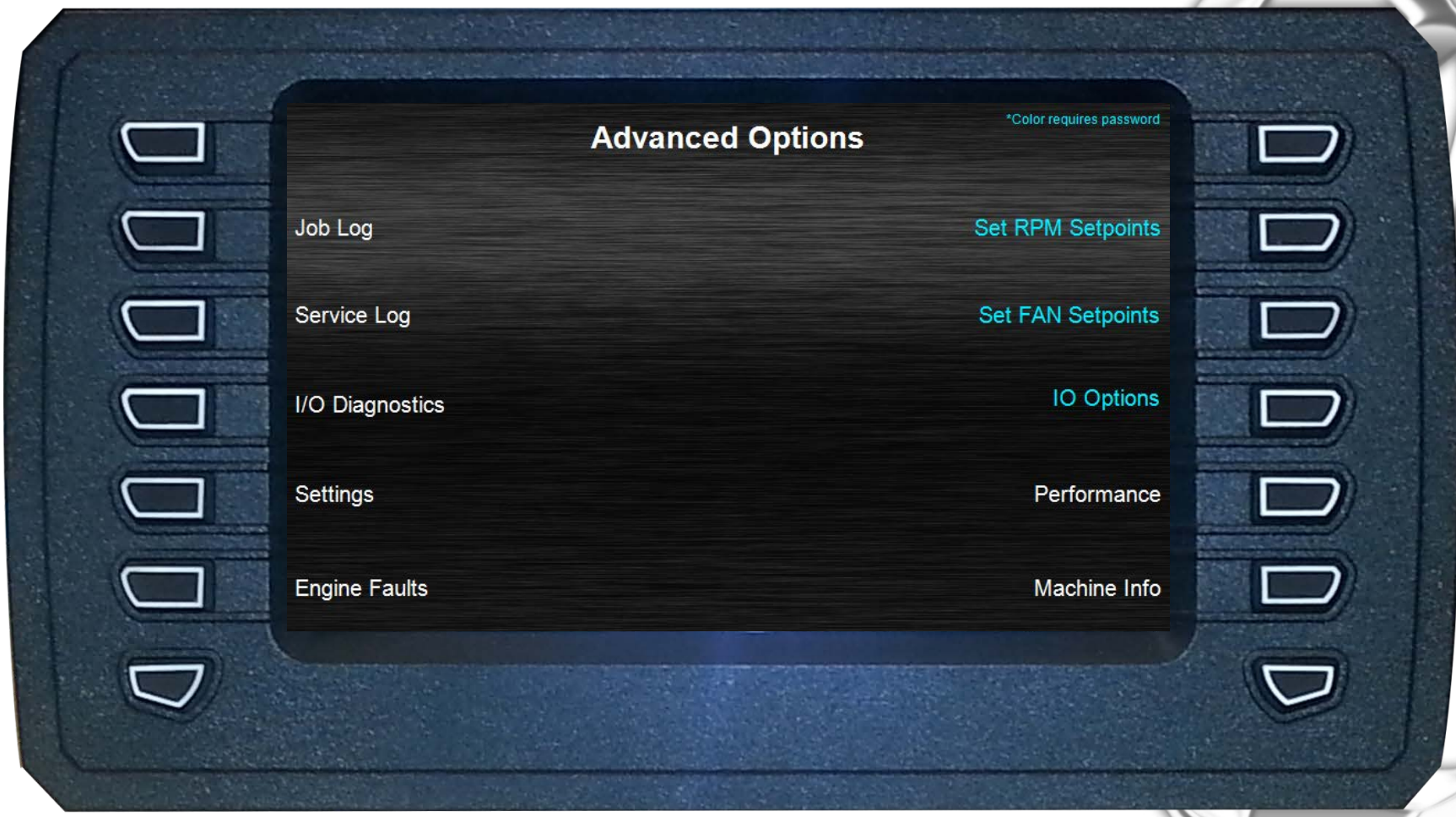
Enter New password to access the "change password screen". Enter minimum of 4 characters then OK.
This will take you to next screen.

Re-enter new password. Then OK
now you have changed your password

RPM SET POINT PROGRAM SCREEN

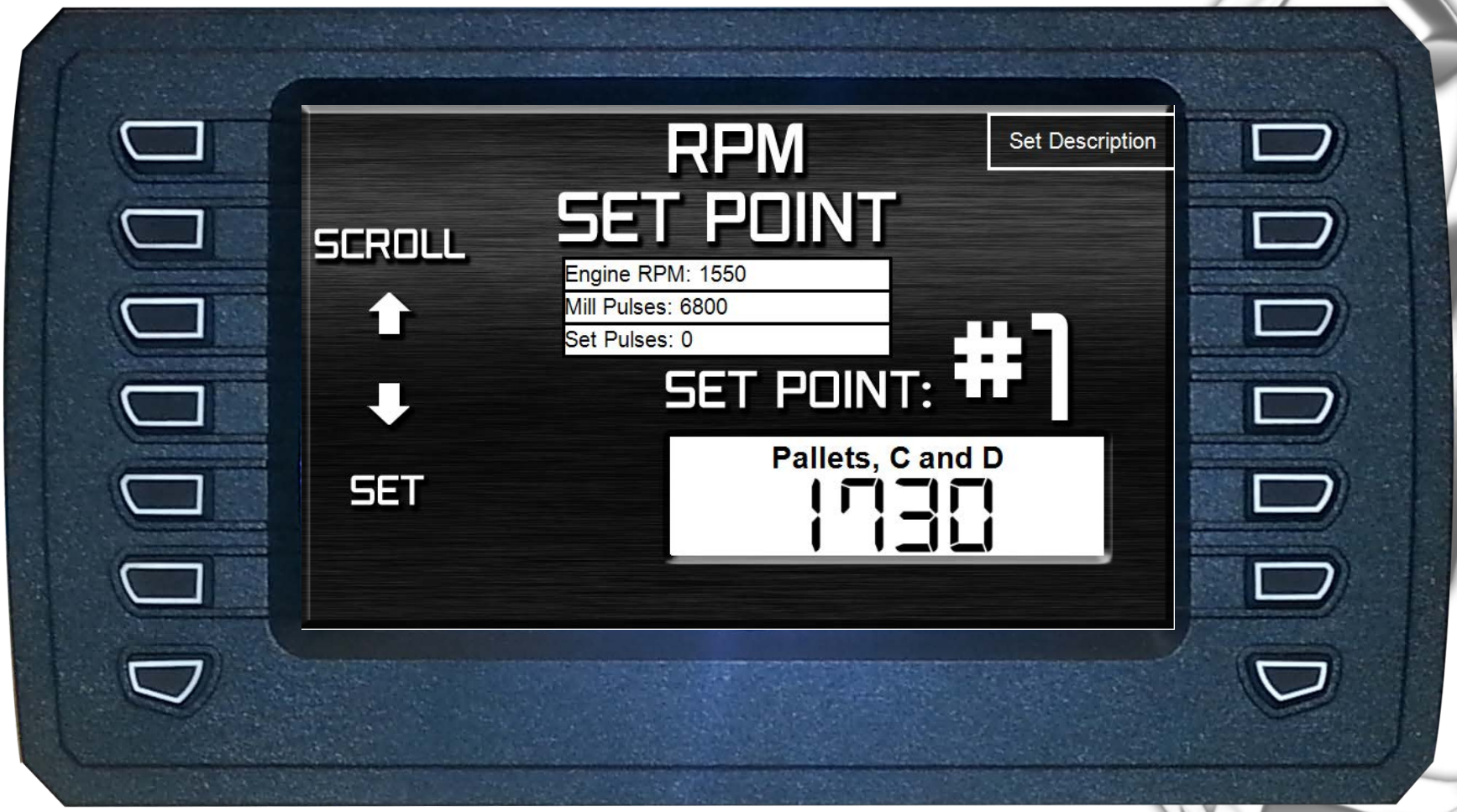


This screen allows you to pre set 3 individual set points or set them all as the same so your operator cannot change them



Select "Set RPM Setpoints" and enter your password

To set the RPM set point you will need to get the engine as close to the desired RPM as possible. Push set. The mill Pulses and Set Pulses will match.

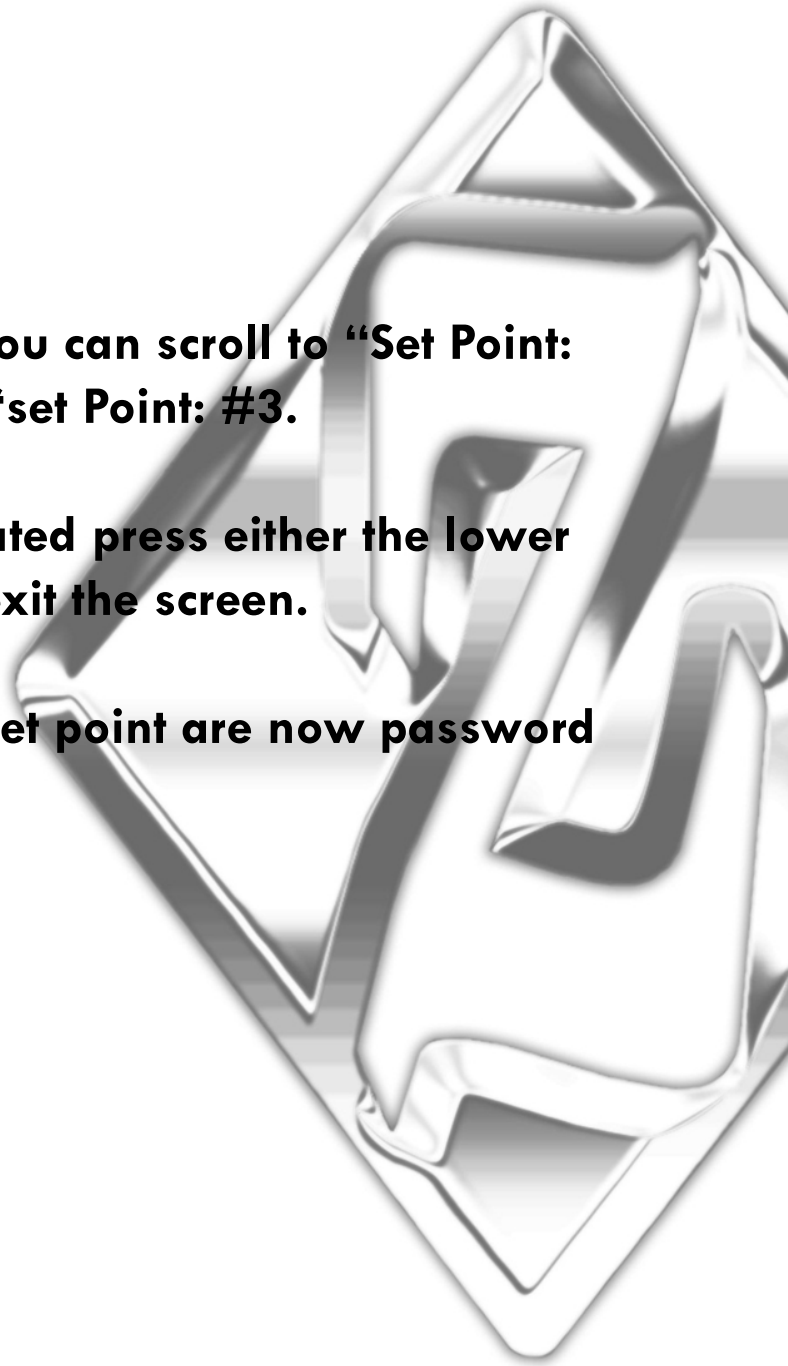


- As you can see in this depiction the set pulses are showing 0 so this means they have not been set. There should be a numeric value here if they are set.
- Engine RPM: This is the current engine RPM.
- Mill Pulses is the current proximity switch pulses from the hammer mill. This tells you if you have a proximity switch input when the hammer is engaged.
- Set pulses is the set point pulses that the set point is set at. This will only change when the RPM set point is changed.

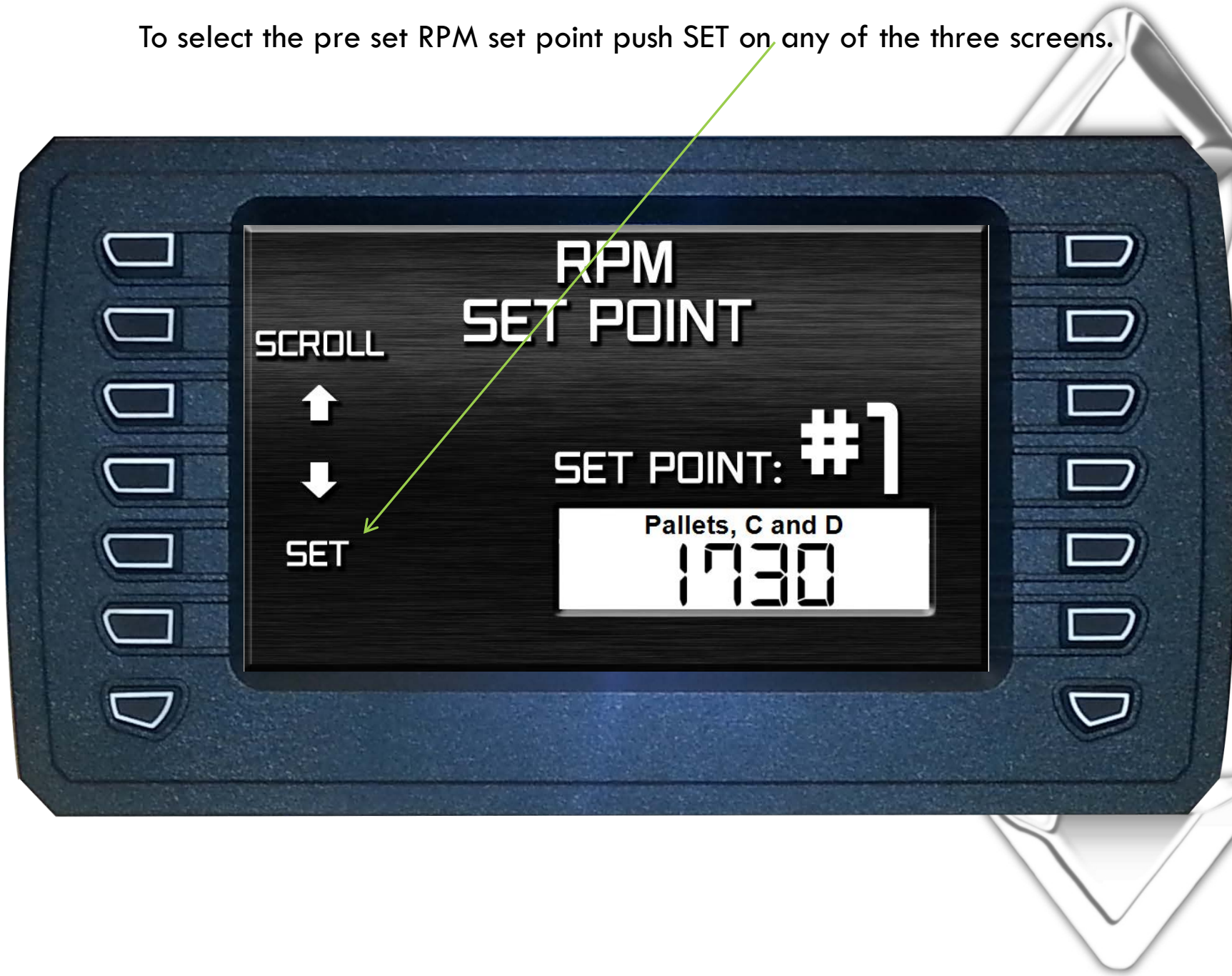
Once you have created “Set Point: #1 you can scroll to “Set Point: #2 to set it and then on to “set Point: #3.

Once all three set points have been created press either the lower left or right hand button to exit the screen.

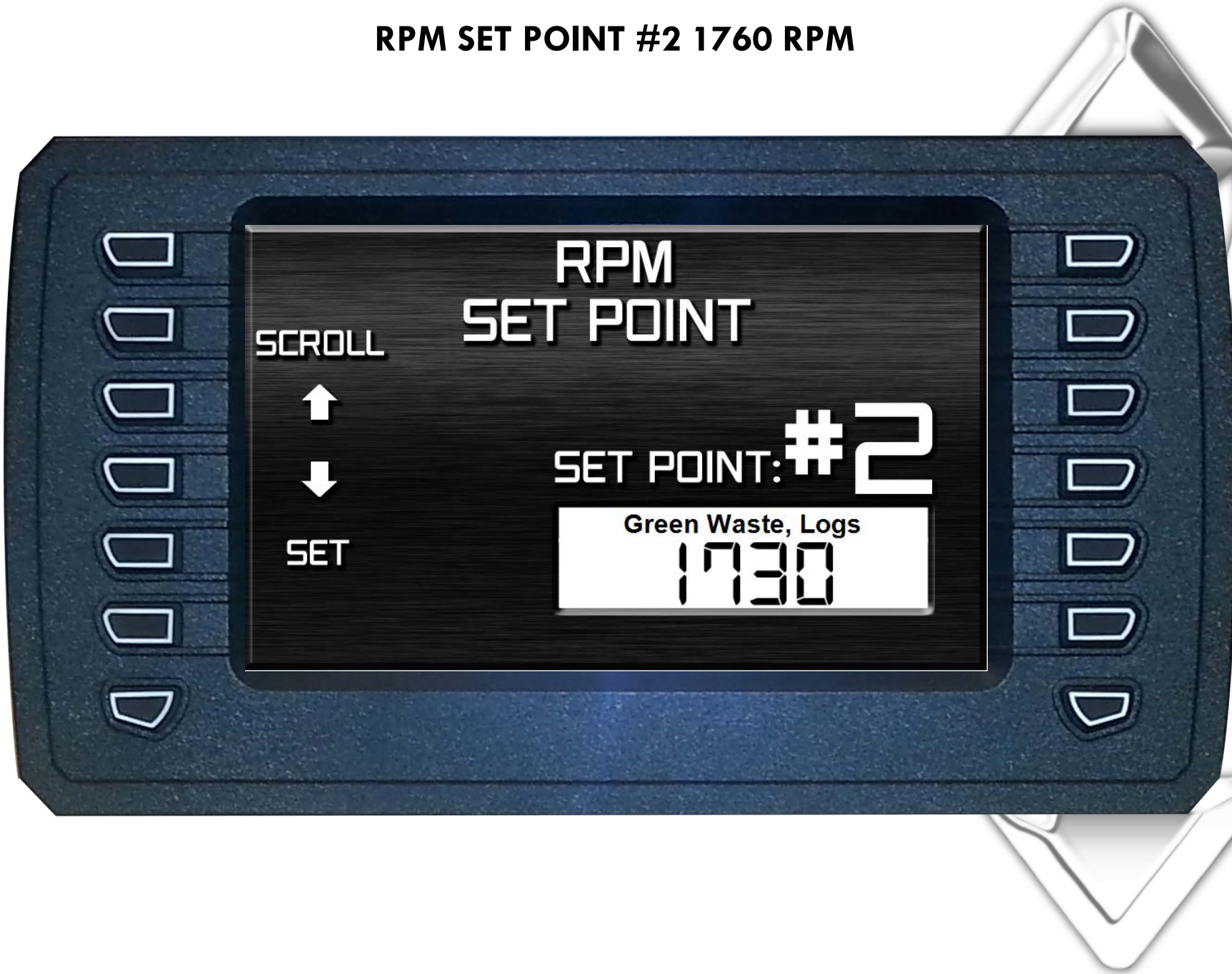
Once the screen has been exited theses set point are now password protected.



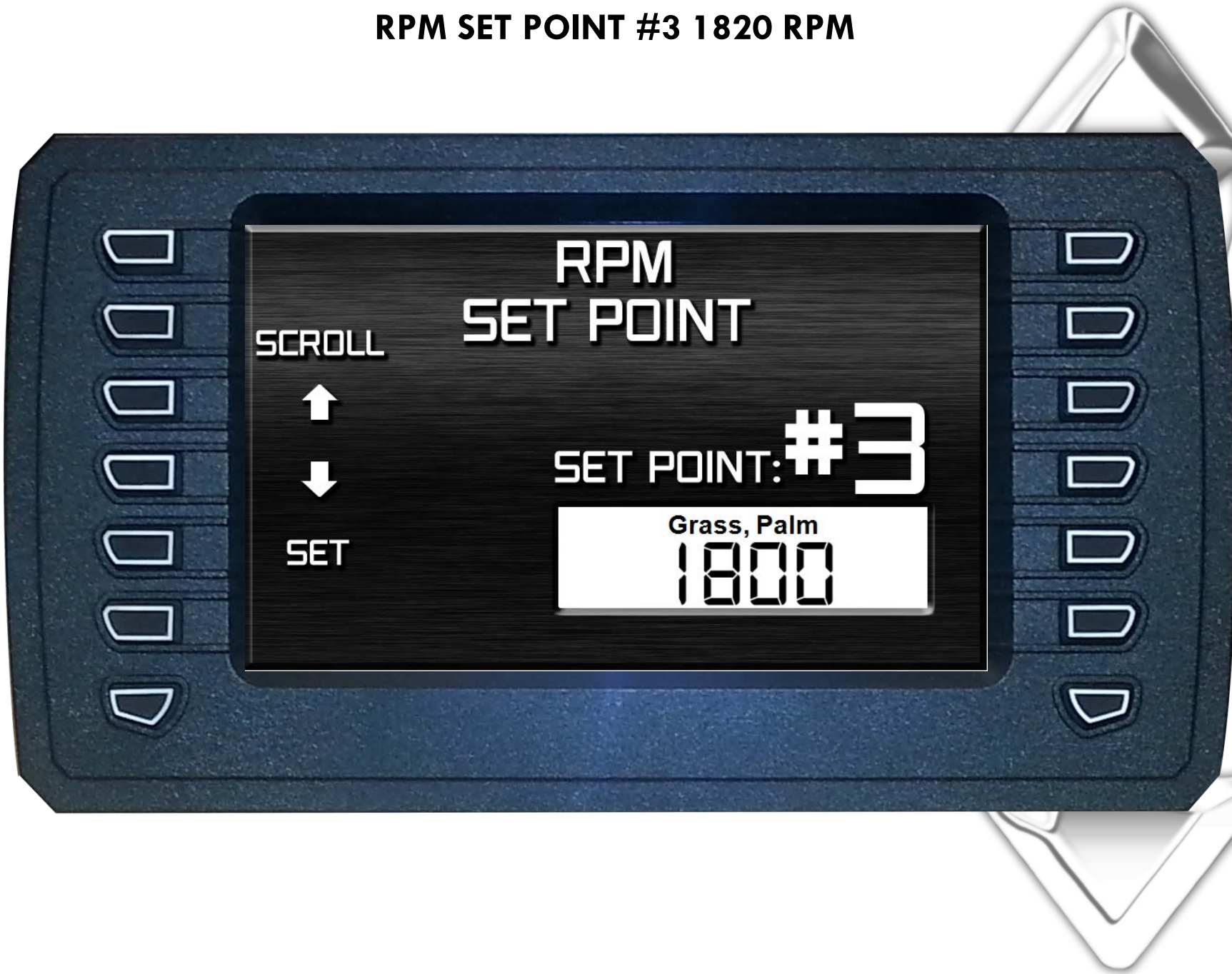
To select the pre set RPM set point push SET on any of the three screens.



RPM SET POINT #2 1760 RPM



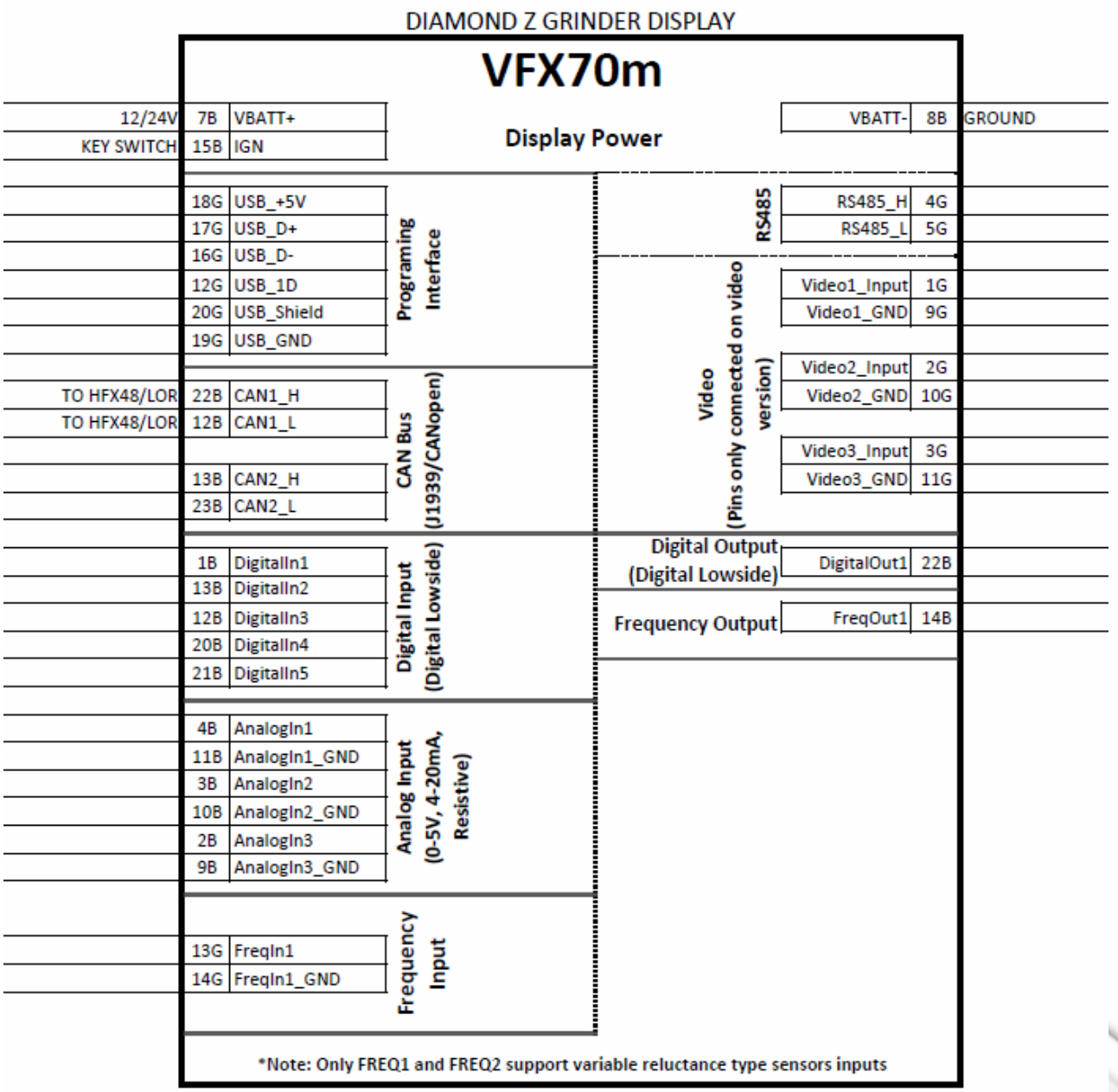
RPM SET POINT #3 1820 RPM



Service Log Screen

This screen can be programed to track operational hours of any maintenance related item

Schematics



EATON SCREEN WIRING LAYOUT

Eaton Main Controller Wiring Layout/Fault Codes

DIAMOND Z GRINDER

HFX48m

Controller Power

12/24V	6A	VBATT+	VBATT-	7A	GROUND
N/A	26A	Sleep			
KEY SWITCH	16A	IGN			

Output Power

12/24V	9A	Load_PWR+	Load_PWR-	18A	GROUND
12/24V	10A	Load_PWR+	Load_PWR-	28A	GROUND
12/24V	19A	Load_PWR+	Load_PWR-	29A	GROUND
12/24V	1B	Load_PWR+	Load_PWR-	12B	GROUND
12/24V	2B	Load_PWR+	Load_PWR-	13B	GROUND
12/24V	3B	Load_PWR+	Load_PWR-	22B	GROUND

Programing Interface

	1P	USB_GND
	2P	USB_D-
	3P	USB_D+
	6P	USB_+5V

Sensor Power Supply 1

SENS_PWR+	30A		
SENS_PWR+	21B		
SENS_PWR-	20A		
SENS_PWR-	11B		

CAN Bus (J1939/CANopen)

	4P	CAN1_H
	5P	CAN1_L
TO ENGINE	22A	CAN1_H
TO ENGINE	12A	CAN1_L
TO DISPLAY/LOR	13A	CAN2_H
TO DISPLAY/LOR	23A	CAN2_L
TO HFX20 TRACKS	14A	CAN3_H
TO HFX20 TRACKS	24A	CAN3_L

Sensor Power Supply 2

SENS_PWR2+	15B		
SENS_PWR2+	16B		
SENS_PWR2-	25B		
SENS_PWR2-	26B		

I/O System (24 Inputs/24 Outputs)

Analog/Digital Inputs (0..5V, 0..10V, 0..34V, 0..22mA, Thermistor, Digital High/Lowside)

AIR INTAKE ALARM	21A	INPUT_1
FAN FORWARD 10MIN SWITCH	11A	INPUT_2
FAN FORWARD 40MIN SWITCH	33A	INPUT_3
	34A	INPUT_4
FLUID COUPLER ENGUAGE	25A	INPUT_5
FLUID COUPLER OVER TEMP WARN	15A	INPUT_6
FLUID COUPLER OVER TEMP SHUTD	5B	INPUT_7
FEED FLOOR OVER PRESSURE	7B	INPUT_8
FEED FLOOR FAST	28B	INPUT_9
FEED FLOOR SLOW	19B	INPUT_10
FEED FLOOR REVERSE	18B	INPUT_11
	14B	INPUT_12
RPM SETPOINT 1	17B	INPUT_13
RPM SETPOINT 3	27B	INPUT_14
ROLLER MAINTANCE HATCH	9B	INPUT_15
MILL COVER OPEN	8B	INPUT_16

Frequency/Digital Inputs (Digital High/Lowside, Variable Reluctance*)

MILL PULSE COUNTER	36A	FREQ1_POS
	37A	FREQ1_NEG
RPM BYPASS SWITCH	38A	FREQ2_POS
	39A	FREQ2_NEG
ROLLER OVER PRESSURE	17A	FREQ3
RPM SETPOINT SAVE	27A	FREQ4
ROLLER FLOAT ON	10B	FREQ5
ROLLER FLOAT OFF	20B	FREQ6
	29B	FREQ7
	30B	FREQ8

PWM/Digital Outputs -2A (Current Feedback, Digital Highside)

PWM1_2A	2A	ROLLER UP
PWM2_2A	3A	ROLLER DOWN
PWM3_2A	4A	MAINTANCE ALARM
PWM4_2A	5A	
PWM5_2A	40A	WARNING LIGHT
PWM6_2A	32A	FEED FLOOR/TUB FORWARD
PWM7_2A	35B	FEED FLOOR/TUB REVERSE
PWM8_2A	34B	ROLLER FORWARD
PWM9_2A	33B	ROLLER REVERSE
PWM10_2A	23B	LANDING GEAR DOWN/CONV RIGHT
PWM11_2A	39B	
PWM12_2A	31B	
PWM13_2A	24B	CONVEYER UP
PWM14_2A	36B	CONVEYER DOWN
PWM15_2A	37B	
PWM16_2A	40B	LANDING GEAR UP/CONV LEFT

PWM/Digital Outputs -4A (Current Feedback, Digital High/Lowside)

PWM1_4A	1A	ENGINE RPM INCREASE
PWM2_4A	35A	ENGINE RPM DECREASE
PWM3_4A	31A	ENGINE STOP
PWM4_4A	8A	HYDRAULIC FAN FORWARD
PWM5_4A	38B	ROLLER FLOAT
PWM6_4A	32B	FLUID COUPLER SAFETY KILL
PWM7_4A	6B	HYDRAULIC FAN REVERSE
PWM8_4A	4B	FLUID COUPLER ENGAUGE

*Note: Only FREQ1 and FREQ2 support variable reluctance type sensors inputs

Eaton Controller Track Machine/ Fault Codes

DIAMOND Z TRACK MACHINE

HFX20m

Controller Power

12/24V	6A	VBATT+	VBATT-	7A	GROUND
N/A	26A	Sleep			
KEY SWITCH	16A	IGN			

Output Power

12/24V	9A	Load_PWR+	Load_PWR-	18A	GROUND
12/24V	10A	Load_PWR+	Load_PWR-	28A	GROUND
12/24V	19A	Load_PWR+	Load_PWR-	29A	GROUND

Programing Interface

	1P	USB_GND
	2P	USB_D-
	3P	USB_D+
	6P	USB_+5V
	4P	CAN1_H
	5P	CAN1_L

Sensor Power Supply 1

SENS_PWR+	30A	N/A
SENS_PWR-	20A	N/A

CAN Bus (J1939/CANopen)

TO HFX48	22A	CAN1_H
TO HFX48	12A	CAN1_L
	13A	CAN2_H
	23A	CAN2_L
	14A	CAN3_H
	24A	CAN3_L

I/O System (24 Inputs/24 Outputs)

Analog/Digital Inputs (0..5V, 0..10V, 0..34V, 0..22mA, Thermistor, Digital High/Lowside)

TRACK ENABLE	21A	INPUT_1
LEFT FORWARD	11A	INPUT_2
LEFT REVERSE	33A	INPUT_3
RIGHT FORWARD	34A	INPUT_4
RIGHT REVERSE	25A	INPUT_5
BRAKE RELEASE	15A	INPUT_6

Frequency/Digital Inputs (Digital High/Lowside, Variable Reluctance*)

	36A	FREQ1_POS
	37A	FREQ1_NEG
	38A	FREQ2_POS
	39A	FREQ2_NEG
	17A	FREQ3
	27A	FREQ4

PWM/Digital Outputs -2A (Current Feedback, Digital Highside)

PWM1_2A	2A	TRACK RIGHT FORWARD
PWM2_2A	3A	TRACK RIGHT REVERSE
PWM3_2A	4A	TRACK LEFT FORWARD
PWM4_2A	5A	TRACK LEFT REVERSE
PWM5_2A	40A	
PWM6_2A	32A	

PWM/Digital Outputs -4A (Current Feedback, Digital High/Lowside)

PWM1_4A	1A	TRACK BRAKE
PWM2_4A	35A	TRACK ALARM
PWM3_4A	31A	
PWM4_4A	8A	

*Note: Only FREQ1 and FREQ2 support variable reluctance type sensors inputs

LED A (left-most) - Green power LED

Off ==> Not powered up
Solid on ==> Powered up and Pro-Fx Control not running
Fast flash (100ms on, 100ms off) ==> Pro-Fx Control running

LED B (middle) - Red MIL light

Pro-Fx Control application running

Flashing (200ms on, 200ms off) ==> critical fault is active

Solid on ==> standard fault is active

Off ==> no fault

Prof-Fx Control not running

Fast Flashing (200ms on, 200ms off) ==> critical fault is active

Slow pulse (100ms on, 1500ms off) ==> historic fault is set - must be manually cleared

Solid on ==> standard fault is active

Off ==> no fault

LED C (right-most) - Green user programmable LED

User programmable via System Config I/O variable