Pyrokos Control System

OPERATION & MAINTENANCE MANUAL

CONTENTS

FUNCTIONAL OVERVIEW

The unit has 2 main modes of operation:

1. FIRE PUMP CONTROL
2. STOP-START PUMP CONTROL

NOTE: - This version also requires processor on the main relay module (D13242) to have Software Version 0_9 (Normal Fire Pump Mode) or Version 0_9ONOFF (Stop-Start Mode)

The MODE is read from the Engine Parameter Register 0 (Model ==D13242 for FIRE CONTROL Mode and Model==D13243 for STOP –START Mode).

The software version label shows:

FIRE PUMP Control – S/w version Label is V0_9

STOP-START Mode – S/w Version label is V0_9 ONOFF

The system MODE can be identified on the second startup display showing either:-

"FFFF" for FIRE CONTROL MODE
"bbbb" for STOP-START MODE

a. FIRE PUMP CONTROL

The Fire Pump Controller has the primary function of starting a diesel fire pump with a high degree of reliability.

The Specification document "Fire Pump Controller Specification_2.doc" provides further background into the hardware and software features.

The main processor and peripheral hardware (e.g. Display, switches and relays) have ancillary functions to provide the following:

(a) Monitoring with numeric indications of levels
(b) Status indications of power and alarm conditions
(c) Button inputs for user control of
    (1) Viewing and Setting Calibrations & Parameters
    (2) Testing
    (3) Resetting Alarms
    (4) Manual Override

b. STOP-START CONTROL

The STOP-START control allows the pump to be STARTED with a closed contact on the Pressure Switch input and then to STOP the pump by opened contact on the Pressure Switch input

The functioning of the Display, Monitoring, Alarms, Logging and User Parameters are mostly the same as for the FIRE PUMP CONTROL mode, with the main differences being:-

(1) The Pressure Switch does not generate a common alarm, but the ON/OFF status is still shown on the LED display.
(2) The "STOP" relay can be optionally configured as a "RUN" relay and switches the fuel solenoid continuously on when engine is cranking and running, and switches it off when engine is required to be stopped.
(3) Any other of the Common Alarms will force the Engine Processor into STOP-OVERRIDE state which will shut the pump off until the fault can be cleared.
(4) User Configured Delays for Engine Start, Stop and Restart times.
(5) User Configured Delays for the alarm inputs to prevent false triggering.
(6) Fuel Low Level Warning, as well as Low Fuel Shutdown. Fuel Low Level Warning can also be assigned to one of the VFC relays.
(7) Provision is for one only Battery and Charger. The battery voltage is shown in the "Start" battery display and the battery charging current is now shown in the "Control" battery display.

The Engine Processor can also be user configured for 2 modes for RUN or STOP fuel solenoid operation. This program via the display menu 43 or Serial diagnostics, update register command "2 63"

MODE=0 (Default): RUN solenoid operating mode – which is ON during cranking and is OFF when the engine is OFF

MODE=1: STOP solenoid operating mode – which is OFF for engine cranking and run and is switched ON momentarily to shut down the engine, then returns to OFF when the engine has stopped.

HARDWARE OVERVIEW

a. COMPONENTS

Referring to the block diagram in Appendix 3.1, the following main components are identified, with a brief description of functions.

2.a.1 D13242 – Main Module

This module provides the central hub for all interconnections.
It has an on-board microcontroller as a standalone processor which is controlling the engine starting operations.
It contains relays to operate the engine crank and stop solenoids.
It connects to the D13241 Display Module
It connects to the D13244 VFR Relay Modules
It has 6 push button tact switches for parameter viewing and configuration.
It has interfaces for Engine sensors.

ENGINE START PROCESSOR.
This is a stand-alone processor, which can function independently of the main processor module.
It has only the essential inputs and driver outputs for the engine start functions.

This processor has sensor inputs for:-

- Low Pressure (Fire Detection System),
- RPM / Tacho Sensor (Engine Speed)

This processor also detects the 6 on-board tact switches.

2.a.2 D13241 – Display Module

This module is mounted on the front panel and is the primary operator interface
This module provides 9x numeric displays and 18 LED indicators.
It has inputs for 5 panel switches.
The module communicates using RS485 line interface.
It uses the Modbus Protocol for relaying control and status information.

2.a.3 D13241 – Remote Display Module

A second remote display can be connected to J1 – REMOTE DISPLAY connector on the main module D13242.
It uses Modbus protocol over an RS485 line interface.
The Cable distance is typically up to 2Kms.
Two configurable option bits are used to Enable the Remote Display, and also to Enable remote buttons.

2.A.4 D13244 – Relay Output Module

Each D13244 module has 8 relays. Two of these have SPDT Form C change over contacts, and 6 have SP Form A contacts (Normally Open)

Two of these modules can be connected to provide a total of 16 relay outputs.

2.A.5 D13401 – Main Processor Module

This module provides monitoring, display and status logging functions.

Note – it does not have any control of the engine starting, which is performed by the dedicated processor on the D13242 Main Module.

Logging is saved to 32KByte non-volatile EEPROM.

A FLASH Ram IC can also be fitted

2.a.6 Batteries

1 or 2 batteries are provided depending whether the system is for FIRE pump control or is for STOP-START system .

These may be 12 or 24Vdc, and must be the same voltage

NOTE: THE MAIN MODULE (D13242) MUST BE MATCHED FOR CORRECT VOLTAGE

FIRE PUMP CONTROL MODE:

2 Batteries are provided for additional reliability of the Fire Pump System.

(1) Crank Battery -is main 12 or 24 Vdc battery used to drive the starter motor

(2) Control Battery – provides 12 or 24Vdc battery to supply the control circuits.

The Engine can also be manually started from the Control Battery if required.

STOP-START PUMP CONTROL MODE

1 Battery only is provided for the starter motor cranking and also powers the Control Circuits.

A 3.0V Lithium Battery is also provided on the main processor module (D13401) which maintains operation of the Real Time Clock

2.a.7 D13243 – Crank Battery Charger

This is a charger dedicated in maintaining the optimum charge capacity of the Crank Battery.

Charging current is monitored by the Main processor module.

2.a.8 D13401 – Control Battery Charger

NOTE: USED FOR FIRE PUMP CONTROL SYSTEMS ONLY

This is a charger dedicated in maintaining the optimum charge capacity of the Control Battery.

Charging current is monitored by the Main processor module.

2.a.9 Engine Solenoids

Three solenoids are operated,

(1) Cranking Solenoid
(2) Alternator Isolate Solenoid
(3) Engine Stop Solenoid

2.a.10 Engine Sensing

The following conditions are monitored by the Main Processor.

(1) Fuel Gauge
(2) Low Fuel Switch
(3) Oil Sender (Pressure)
(4) Temperature Sender
(5) Engine Speed / RPM

2.a.11 Other Sensing

The following conditions are also monitored by the Main Processor

(1) Crank Battery Voltage
(2) Crank Battery Current
(3) Control Battery Voltage (FIRE Systems only)
(4) Control Battery Current (FIRE Systems only)
(5) Mains Voltage Available to Crank Charger
(6) Mains Voltage Available to Control Charger (FIRE Systems only)
(7) Manual Control Switch
(8) Manual Start Switch
(9) Local 12V Voltage

2.a.12 Diagnostic Port

Provides RS232 Serial Interface

A simple command console allows connection to a PC running a simple ASCII terminal (E.g. MS Windows Hyperterm)

The user can view and set parameters, and dump the status log.

2.a.13 USB Port

The module implements a CDC class which means it will appear as a com port on the PC. Although the PC may allow com port parameters such as baud rate to be set they have no effect.

The USB port runs the same command console as for the Diagnostics Port.

SOFTWARE SPECIFICATION

a. DISPLAY MODULE

The document "D13241_user_manual_A0_1.doc" describes the operation of the Display Module.

Note the following:-

The module uses the Modbus Protocol.

In preparing this product the following documents from Modbus-IDA.org were considered:-

MODBUS Application Protocol Specification V1.1a

MODBUS over serial line specification and implementation guide V1.01

The implementation is a reduced set of that proposed in these documents and adjusted to suit industry conventions

Default Address is 4

Default Data Format is 9600 Baud, 8 Bits, Even Parity, 1 Stop bit

The main processor module will need to implement the api as a Modbus HOST.

It will need to be poll the display frequently (ideally 10x per second or at least 5x per second) so that the button functions are responsive.

LEDs and Numeric Instrumentation Displays should be updated as the values are changed and within 1 second response.

b. SYSTEM STARTUP DISPLAY

When the system is started a sequence of numbers appears in the numeric LED fields

FIRST SCREEN:

RPM – Display Software Version

OIL PRESSURE – Display Mode

SECOND SCREEN:

RPM – Main Processor Software Version

HOURS – Engine Processor Software Version

START BATTERY – SYSTEM VOLTAGE (12/24V)

CONTROL BATTERY – SYSTEM MODE

"FFFF" = FIRE PUMP CONTROL

"bbbb" = STOP-START PUMP CONTROL

c. NUMERIC DISPLAYS

There are 9 numeric 4 digit displays on the display module.

The numeric displays are assigned as follows:-

Display Number FIRE SYSTEM MODE	Display Number STOP-START MODE	Function	Units	Range	Resolution
D1	D1	Hours	Hours	0..9999	1
D2	D2	Oil Pressure	kPa	0..600	1
D3	D3	Temperature	DegC	0..200	1
D4	D4	Alternator Amps	Amps	0..100	0.1
D5A **	D5	Start Battery Volts	Volts	0..35	0.1
D5B **	D6	Start Battery Charging Amps	Amps	0..10	0.1
D6A **		Control Battery Volts (FIRE SYSTEMS ONLY)	Volts	0.35	0.1
D6B **		Control Battery Charging Amps (FIRE SYSTEMS ONLY)	Amps	0..9	0.01
D7	D7				
D8	D8	Fuel Tank Level	%	0..100	1
D9	D9	Engine Speed	RPM	0..9999	10

NOTE: Displays marked ** have different function depending whether the system is running in FIRE PUMP CONTROL or STOP-START CONTROL mode

In FIRE mode the displays are multiplexed with voltage and amps.

These alternate at a 3 second rate.
The displays show “nn.nu” for Voltage and “n.nnA” for Amps

In STOP-START mode the display D5 shows the Battery Voltage, and D6 shows the battery charge current.

d. NUMERIC DISPLAYS – OUT OF RANGE CONDITIONS

The displays flash at a slow rate when out-of-range condition is detected.

Display Number FIRE MODE	Display Number STOP-START MODE	Function	Units	Out of Range Conditions
D1	D1	Hours	0.1 Hours <1000 then 1 Hr >=1000	>9999 or if invalid read from EEPROM
D2	D2	Oil Pressure	kPa	Low Pressure Set by Parameter
D3	D3	Temperature	DegC	High Temp Set by Parameter
D4	D4	Alternator Amps	Amps	>99.9
D5A **	D5	Start Battery Volts	Volts	<10 or >16 (12V System) <20 or >32 (24V System)
D5B **	D6	Start Battery Charging Amps	Amps	<0 or >9.9
D6A **		Control Battery Volts (FIRE SYSTEMS ONLY)	Volts	<10 or >16 (12V System) <20 or >32 (24V System)
D6B **		Control Battery Charging Amps (FIRE SYSTEMS ONLY)	Amps	<0 or >9.9
D7	D7			Not Used
D8	D8	Fuel Tank Level	%	Low Fuel Set by Parameter
D9	D9	Engine Speed	RPM	Low and High Engine Speed Set By Parameters

e. LED INDICATORS

The LED indicators are allocated as per the following table.
The LED will be lighted when the Condition is exceeded

D13241 Register & Bit Map Position	LED Position	Allocated to Common Alarm	Function	Alarm/Led On Conditions
22_0	D10		Pump Available	Engine start processor is in STOPPED/Ready State & no other common alarms are indicated
22_1	D11	Y	Pump Running	Engine start processor is in RUN state or RPM > 100RPM
22_2	D12	Y	Auto Start Isolated	When Auto Isolate Switch is operated via the Display module and Engine start processor is in AUTO_ISOLATED mode
22_3	D13	Y	Engine Fail to Start	Engine start processor is in RESTART_LIMIT state. Is reset with Alarm Reset Button
22_4	D14	Y	Low Fuel Level	Fuel Level < parameter set point or fuel level sensor is operated. Cleared by Alarm Reset button if the fault is rectified
22_5	D15	Y	Engine Overspeed Shutdown	Engine start processor is in STOPPED_OVERSPEED state. Cleared by Alarm Reset button
22_6	D16	Y	High Engine Temperature	Temperature >120 DegC
22-7	D28	Y	Low Oil Pressure	Engine Running & <Parameter Set Low
22_8	D17	Y	Control Battery Charger Fail (FIRE SYSTEMS ONLY)	Control Batt Voltage <13V & Charge current < 1Amp
22_9	D18	Y	Start Battery Low Voltage	(<8V when Engine start processor is in CRANKING state or Manual Cranking) or otherwise <11.8V Cleared by Alarm Reset button
22_10	D19	Y	Control Battery Low Voltage(FIRE SYSTEMS ONLY)	<8V when Manual Cranking from Control Battery or otherwise <11.8V Cleared by Alarm Reset button
22_11	D20		Audible Alarm Muted	When Audible alarm is in a muted state either via the MUTE switch via the Display module or the EXTERNAL MUTE input. Cleared by Alarm Reset Button

22_12	D21	Y	System Low Water Pressure	On when the Low Pressure signal is received via the engine start processor for more than 5minuntes. Cleared by Alarm Reset button
22_13	D22	Y	Water Supply Tank Low Level	??
22_14	D23		AUX 1	When Aux 1 (P_DIN3) is pulled low
25_0	D29		Power Available	ON when Internal 12Vdc is within the range 8V to 20V
25-1	D30	Y	AUX 2	When Aux 2 (P_DIN5) is pulled low
25_2	D31	Y	Start Battery Charger Fail	Start Batt Voltage <13V & Charge current < 1Amp

f. CALIBRATION FACTORS

2.f.1 Temperature Calibration

Temperature Calibration simply selects a Calibration Table to suit the particular Temperature Sensor

Currently there are two Calibration Tables available

(0) Table 0 = Temperature Sensor type VDO 320.002

(1) Table 1 = Temperature Sensor VDO 320.021

2.f.2 Oil Pressure Calibration

Oil Pressure Calibration simply selects a Calibration Table to suit the particular Oil Pressure Sensor

Currently there is one Calibration Tables available

(0) Table 0 = Oil Pressure Sensor type VDO 360.002

2.f.3 Fuel Sensor Calibration

Fuel Sensor Calibration simply selects a Calibration Table to suit the particular Fuel Sensor

Currently there are 2 Calibration Tables available

(0) Table 0 = Linear 180 Ohms Sensor

(1) Table 1 = Linear 90 Ohms Sensor

g. VFC Relay Outputs

There are 8 Voltage Free Contacts (VFC) available,

A second Relay Module can be added to provide and additional set of 8 relays for a total of 16 relay outputs.

These are configured via Registers 27 to 42. Refer Table 2.I.32.I.3

** **NOTE:** COMMON ALARM is activated when any of the following alarms are on:-

MAINS POWER FAILURE (AFTER TIMEOUT IN REGISTER 26)
PUMP RUNNING (FIRE PUMP MODE ONLY)
ENGINE FAIL TO START
LOW FUEL
OVER-SPEED
ENGINE HIGH TEMPERATURE
LOW OIL PRESSURE
START BATTERY CHARGER FAILED
CONTROL BATTERY CHARGER FAILED (FIRE PUMP MODE ONLY)
START BATTERY LOW VOLTAGE
CONTROL BATTERY LOW VOLTAGE FIRE PUMP MODE ONLY)
LOW PRESSURE

TANK LOW LEVEL
AUX 2 INPUT
INTERNAL FAULT

h. Remote Display Functions

NOTE – Remote display requires main processor software version A1.4 or later and also requires the Engine Control processor on the main relay module (D13242) to have Software Version 0_9 (Normal Fire Pump Mode) or Version 0_9ONOFF (Stop-Start Mode)

The second remote display is connected to J1 – REMOTE DISPLAY connector on the main module D13242.

Both the older D13241 display module and new D132431 display modules are able to work as either main display and/or remote display without change to hardware or firmware.

Both Displays mirror each other in the information which is displayed and also button functions, e.g.

The buzzer will sound at both displays, and the mute button will stop the buzzer at both display units,

Panel switches for Mute, Lamp Test and Alarm Reset are operational, whilst the Auto Isolate, Speed Test, Start and Stop buttons are not available to be used.

In programming mode, only the local display will show the parameter details, while the remote display will display 'Prog', and the display will give a short beep and start flashing.

Connection to the remote display will be via the dedicated 4 wire screw terminals J15 on the D13242 main PCB. Note - 12Vdc supply @1.0 Amps may be required for the remote display if the cable voltage drop is more than 2V.

i. Panel Switches

REFER to The Specification Doc Section 5.1 for the functional descriptions

j. Main Module LEDs

The LEDs indicate the system status.

Generally speaking, if the PUMP is ready for start the "PUMP AVAILABLE" LED will be on.

Otherwise, if it is not on then a fault indication will be given by one or more of the other LEDs.

Excepting for "System Low Water Pressure" LED which for STOP-START mode does not cause a fault condition, but still reflects the current status of the LOW Pressure input.

k. Main Module Buttons

Six Buttons are provided – Esc, Enter, Left, Right, Up and Down.

These are used to place the system into a programming and diagnostics mode.

See Section below for operation of these.

Parameter Register descriptions

2.1.1 MAIN PROCESSOR Register descriptions

The following parameter registers parameters (16 bits wide) are used for controlling the functions of the system. They are available for reading (R) setting or writing (W).
They may be viewed and set via the buttons on the main module or via the RS232 Diagnostics port

Holding Register	Type	Access	Name	Units	Default	Comment
0	Unsigned	R	MODEL		1324	For D1324
1	Unsigned	R	SW_VERSION_MAIN		0	10 x version. So version 2.7 would be 27
2	Unsigned	R	SW_VERSION_ENGINE_START		0	
3	Unsigned	R/W	BITMAPPED OPTIONS		0	See Table 2.1.2
4	Unsigned	R/W	Spare		0	
5	Unsigned	R/W	Spare		0	
6	Unsigned	R/W	Spare		0	
7	Unsigned	R/W	Spare		0	
8	Unsigned	R/W	RPM_LOW	RPM	400	
9	Unsigned	R/W	RPM _HIGH	RPM	3200	
10	Unsigned	R/W	RPM_CAL		120	Tacho Teeth
11	Unsigned	R/W	OIL_PRESSURE_LOW	Kpa	100	
12	Unsigned	R/W	OIL_PRESSURE_CAL		0	Calibration Table No.
13	Unsigned	R/W	TEMP_LOW	DegC	5	
14	Unsigned	R/W	TEMP_HIGH	DegC	110	
15	Unsigned	R/W	TEMP_CAL		0	Calibration Table No.
16	Unsigned	R/W	AMPS_CAL	*10 mA	100	
17	Unsigned	R/W	FUEL_LOW	%	70	(10 for STOP-START)
18	Unsigned	R/W	FUEL_OPTIONS		1	
19	Unsigned	R/W	FUEL_CAL		0	
20	Unsigned	R/W	USER_PASSCODE		2680	
21	Unsigned	R/W	Spare		0	
22	Unsigned	R/W	START_BATT_VOLTAGE_CAL		100	
23	Unsigned	R/W	CONTROL_BATT_VOLTAGE_CAL		100	
24	Unsigned	R/W	CHARGER_CURRENT_OFFSET_CAL		0	Offsets Fuel Sensor for Offset

						caused by charger current
25	Unsigned	R/W	FAN_RUN_ON_CAL	Seconds	120	
26	Unsigned	R/W	POWER_FAIL_TIMEOUT	Minutes	240	
27	Unsigned	R/W	RELAY_1_OPTION		1	
28	Unsigned	R/W	RELAY_2_OPTION		19	
29	Unsigned	R/W	RELAY_3_OPTION		3	
30	Unsigned	R/W	RELAY_4_OPTION		6	
31	Unsigned	R/W	RELAY_5_OPTION		16	
32	Unsigned	R/W	RELAY_6_OPTION		1	
33	Unsigned	R/W	RELAY_7_OPTION		19	
34	Unsigned	R/W	RELAY_8_OPTION		3	
35	Unsigned	R/W	RELAY_9_OPTION		15	
36	Unsigned	R/W	RELAY_10_OPTION		8	
37	Unsigned	R/W	RELAY_11_OPTION		9	
38	Unsigned	R/W	RELAY_12_OPTION		24	
39	Unsigned	R/W	RELAY_13_OPTION		25	
40	Unsigned	R/W	RELAY_14_OPTION		14	
41	Unsigned	R/W	RELAY_15_OPTION		4	
42	Unsigned	R/W	RELAY_16_OPTION		20	
43	Unsigned	R/W	Fuel_level_warning		70	(50 for STOP-START)
44	Unsigned	R/W	Alarm_delay		10 (Seconds)	
45..47	Unsigned	R/W	Spare		0	
48-63	Unsigned	R/W	MAPPED TO ENGINE START REGISTERS, 0..15 Refer 3			

2.1.2 Register 3 - Bitmapped Options

BIT	VALUE (** Note)	PARAMETER	OPTION SETTING
0	1	Enable Remote Buttons	0=Buttons Inactive (default), 1=Buttons Active
1	2	Enable Remote Display	0=Remote Display Disabled (default) 1=Remote Display Enabled
2	4	System Voltage	0=12V (default) 1=24V
3	8	Differential AtoD for fuel sensor	0=Single Ended AtoD (<Rev C) 1=Differential AtoD (Rev D)
4	16	Stop-Start-System	0=Normal Fire System 1=Stop-Start Control

5	32	Water-Level-Stop-Pump	0=No Shutdown On Low Water Level 1= Shutdown On Low Water Level
5	64	Oil Pressure Disable	0=Oil Pressure Normal (Enabled) 1=Oil Pressure Disable

** **NOTE:** Register Value = Sum of the Values x Option Set
Example – to set options for 24V system with Stop-Start Control and all other options =0, then
Register Value = 4*1 + 16*1 = 20

2.13 Register 27 to 42 - Relay Option

Each relay (1 to 16) can be programmed with a value which will cause the relay to be operated when the condition is set.

OPTION VALUE	OPTION CONDITION
0	Relay is NOT operated
1	Mains Power Available
2	Pump Available
3	Pump Running
4	Auto Isolated
5	Failed Start
6	Low Fuel
7	Over Speed
8	High Temp
9	Low Oil Press
10	Start Charger Failed
11	Control Charger Failed
12	Start Batt Low V
13	Control Batt Low V
14	Alarm Muted
15	Low Pressure
16	Water Tank Low
17	Jack Pump Run
18	Jacking Pump Fault
19	Common Fault
20	Fan Run On (time set in Register 25)
21	Engine Processor Comms Failed
22	Mains failure – time delay (Delay time set in Register 26)
23	Common Battery / Charger Fault
24	Common Low Battery Fault
25	Common Charger Fault

26	Fuel Level Warning
27	Processor Heartbeat Pulse (1 minute)
28	Common Alarm without Pump Run

2.1.4 ENGINE START PROCESSOR Register Descriptions

Holding Register	Type	Access	Name	Units	Default	Comment
0	Unsigned	R	model		13241	13241
1	Unsigned	R	software version		0	10 x version. So version 2.7 would be 27
2	Unsigned	R/W	SWITCHES_LATCHED		0	Bit Mapped
3	Unsigned	R	SWITCHES_CURRENT		0	Bit Mapped
4	Unsigned	R	PROCESS STATE		0	See Table 2
5	Unsigned	R	RPM (Period count *8uSec)		0	
6	Unsigned	R/W	RPM LOW (Max Period count *8uSec)	*8uSec	0	
7	Unsigned	R/W	RPM HIGH (Min Period count *8uSec)	*8uSec	0	
8	Unsigned	R/W	SPARE		0	
9	Unsigned	R	FLAGS		0	
10	Unsigned	R/W	COMMAND		0	See Table 4.11.4.1
11	Unsigned	R	OUTPUT STATE – current		0	Bit Mapped
12	Unsigned	R/W	START DELAY		(x100mSec)	
13	Unsigned	R/W	RESTART DELAY		(x100msec)	
14	Unsigned	R/W	RUN ON DELAY		(x100mSec)	
15	Unsigned	R/W	OPTIONS		B0- STOP solenoid Function	0=RUN SOLENOID 1=STOP SOLENOID

2.1.4.1 Register 4 – CONTROL BITMAPPED REGISTER

BIT	DESCRIPTION	DESCRIPTION
0	MANUAL RESET	
1	MANUAL STOP	
16	STOP OVERRIDE	STOP/START SYSTEMS

2.1.4.2 Register 4 – PROCESS STATE

STATE NUMBER	ABBREVIATED	DESCRIPTION
0	STOPPED	Normal Idle State
1	WAIT_RESTART	
2	CRANKING	
3	RUN	
4	FORCED_STOP	
5	STOPPED_OVERSPEED	Alarm Condition –requires manual Alarm Reset
6	RESTART_LIMIT	Alarm Condition –requires manual Alarm Reset
7	MANUAL STOP	
8	STOP OVERRIDE	STOP-START mode only – manual Alarm Reset
9	STOP LOW PRESSURE	STOP-START mode only

2.1.5 NOTE ON UPDATING USER CONFIGURATION

For the MAIN PROCESSOR all the read-only registers (3 to 47) stored in EEPROM for the main processor.

For the ENGINE CONTROL PROCESSOR there are 4 registers (12,13,14,15) which are user configurable (via the main registers 60,61,62,63) and these are stored in EEPROM for the Engine Processor. They can also be viewed and updated via menus 40 to 43.

NOTE: This means that if a MAIN MODULE (D13242) is replaced then these registers will need to be checked and updated if necessary.

If the MAIN PROCESSOR MODULE (D1340) is replaced then Registers 3 to 47 will need to be checked and updated..
The LOAD DEFAULTS menu process should be done initially when the processor is first replaced.
However, this will not change any of the Engine Processor Registers (12,13,14,15) and which are found at main Registers 60 to 63.

m. PROGRAMMING MODE

The buttons on the Main Board are used for Programming Mode.

2.m.1 Programming Mode

To enter programming mode – press the buttons in the following sequence.
If the sequence is incorrect, then must start again.

<ESC> <DOWN> <DOWN> <LEFT> <RIGHT> <ENTER>

The display then goes blank with "Prog" displayed in [START BATTERY VOLTS]

2.m.2 Exit Programming Mode

Programming mode will be terminated and the displays returned to normal with any of the following conditions:-

(1) Timeout - automatically exit programming mode after 60 Seconds without any button press.

(2) Pressing the <ESC> button

(3) Low Pressure input triggers an automatic engine start.

2.m.3 General Button Navigation Conventions

<ENTER> is used to save the current set value.

<ESC> exits program mode

<RIGHT> & <LEFT> are used to scroll through the MENU LEVELS

<UP> <DOWN> are used to Increment or Decrement the Set Value.

NOTE: Press and hold starts increments/decrements UP/DOWN at 1 per second
Press UP and then DOWN – increments x10 at 1 increments per second
Press UP and then DOWN – decrements x10 at 1 increments per second

Holding any of the above conditions for more than 5 seconds, then increments or decrements at a fast rate (3 per second)

Values should remain within the designated range

The displays are used in the following way:-

[START BATTERY VOLTAGE] field displays "Prog" while in program mode
[CONTROL BATTERY VOLTAGE / START BATTERY CURRENT] displays the Menu Level
[FUEL LEVEL] displays the current parameter value to be adjusted
[HOURS] is used with the calibration values to display the calculated value in the designated units
E.g. Speed in RPM, Pressure in Kpa, Fuel in %.

NOTE: Enter must be pressed to save the value.
This also updates the [HOURS] field to reflect the current sensor measurement.

2.m.4 Menu Levels

[CONTROL VOLTS] Display = MENU LEVEL	[HOURS] Display =	[FUEL] Display
0		Main Processor S/w Version
1		Engine Start Processor S/w Version
2		Low RPM Threshold
3		High RPM Threshold
4	Current RPM	Cal Value (Flywheel Teeth)
5		Low Oil Pressure Threshold KPa
6	Current Oil Pressure Kpa	Cal Table Number
7		Low Temperature Threshold DegC
8		High Temperature Threshold DegC
9	Current Temperature	Cal Table Number
10	Current Alternator Amps	Cal Value (Shunt Milliohms)
11		Low Fuel Threshold (5 to 95)%
12	Current Fuel Level	Option 0=Low Fuel Switch Only 1=Low Fuel Level Parameter or Low Fuel Switch
13	Current Fuel Level	Cal Table Value
14		Fan Run-on Timer Seconds
15		Options – Refer Table 2.1.2
16		Power Fail Time Delay (Minutes)
d1	Set Date and Time See 4.12.5	Set Day number
d2		Set Month number
d3		Set Year
t1		Set Hours(24Hr)
t2		Set Mins
22		Relay 1 – Option

23		Relay 2 – Option
24		Relay 3 – Option
25		Relay 4 – Option
26		Relay 5 – Option
27		Relay 6 – Option
28		Relay 7 – Option
29		Relay 8 – Option
30		Relay 9 – Option
31		Relay 10 – Option
32		Relay 11– Option
43		Relay 12– Option
34		Relay 13 – Option
35		Relay 14 – Option
36		Relay 15 – Option
37		Relay 16 – Option
38		Fuel Level Warning (5 to 95)%
39		Alarm Delay (0 to 300)seconds
40		Engine Start Delay (10 to 3000)*100mSec
41		Engine Restart Delay (100 to 3000)*100mSec
42		Engine Run_on Time (10 to 3000)*100mSec
43		Engine Processor Options(Bitmapped): B0 – 0= RUN Solenoid, 1=STOP Solenoid
44		Load ALL Factory Defaults 101
45		Load Default RELAY OPTION 101 = Default Option 1 102 = Default Option 2 103 = Default Option 3 104 = Default Option 4

2.m.5 Setting Date & Time

Five numeric displays are used as follows:-

[RPM] = DD (Day number) [TEMP] = HH (Hours – 24Hr)

[HOURS] = MM (Month) [AMPS] = MM (Minutes)

[OIL PRESSURE] = YYYY (year)

As each parameter is selected, the corresponding display flashes.

2.m.6 Setting RPM HI, LO & CAL Values

NOTE: These settings are important to the operation of the ENGINE START PROCESSOR

These settings affect the engine low and hi RPM threshold values.

These in turn can cause the pump engine to be stopped if not set correctly

The Hi and Lo threshold values are the period counts (units x 8usec) of pulses from a tacho.
The Engine start processor also saves these values to internal EEROM, and so with power up reset will retrieve the correct values from EEROM.

Note - the main processor saves these values as RPM using the conversions below.
The main processor also saves the CAL value which represents the number of teeth in the flywheel tacho, which is used in the conversions.

On power-up the main processor to reads the Hi and Lo Period values from the engine start processor and if not agreed (after conversion) with the RPM values saved in main processor EEROM then an alarm flag is set

The event will be logged to EEROM and the also the RPM display is set to fast flash.

The alarm is only cleared by the next good power-up reset.

2.m.7 Hour Meter

The Hours Run is saved with a high degree of security.

The Hours Counter is a 32 bit counter and is incremented in 1 second intervals.

The value is saved every 60 seconds that the engine is running (RPM > minimum), plus one more save after it is stopped.

The displayed HOURS RUN is then the Hours Counter / 360 if the value is <1000*3600 or Hours Counter /3600 if the Hours Counter is >=1000*3600

EG Displays as “nnn.n” up to 999.9 then “nnnn” for > =1000

Three separate copies of the current value are saved in EEPROM (3 * 4 = 12 bytes)

When reading the values (after power-up) the following rules apply:-

If 2 of the 3 values are matched, then is a valid set and the Hours Counter is set to this value. Any value which is larger than 10000*3600 is out of range and is not matched

The current value is then written back to EEROM in the 3 copies.

If all 3 values are not matched, then set the Hours counter to 0xFFFFFFFF.

This will then be displayed as 9999 and cause the display to flash.

2.m.8 Load Relay Defaults

The Value field sets the Relay defaults for each of the 16 relays according to the table below.

VALUE 101 – DEFAULTS = {1,19,3,0,0,0,0,0,0,0,0,0,0,0,0,0},
VALUE 102 – DEFAULTS = {1,19,3,0,0,0,0,20,0,0,0,0,0,0,0,0},
VALUE 103 – DEFAULTS = {1,19,3,0,0,0,0,0,0,0,0,0,0,0,0,0},
VALUE 104 – DEFAULTS = {1,19,3,0,0,0,0,0,0,0,0,0,0,0,0,0},

n. VIEW LOG MODE

The buttons on the Main Board are used to for View Log Mode.

2.n.1 Enter View Log Mode

To enter View Log mode – press the buttons in the following sequence.
If the sequence is incorrect, then must start again.

<ESC> <UP> <DOWN> <LEFT> <RIGHT> <ENTER>

The display then goes blank with "Log" displayed in [START BATTERY VOLTS]

2.n.2 Exit View Log Mode

The View Log Mode will be terminated and the displays returned to normal with any of the following conditions:-

(1) Timeout - automatically exit programming mode after 2 minutes without any button press.

(2) Pressing the <ESC> button

(3) Low Pressure alarm triggers an automatic engine start.

2.n.3 Operation

<ESC> exits view log mode

<UP > & <DOWN> Scrolls through the event log

<LEFT> Return to the last record

<RIGHT> Skip x10 Records

<ENTER. Delays the alternating display for further 10 seconds

2.n.4 View Log Display

The Display has 2 views.
These views are displayed alternately, 2 seconds with the Log Header View, and 5 seconds with the Status View.

2.n.4.1 Log Header View

This displays the record number, date and time in the following fields:-

[START BATTERY VOLTS]= "Log"

[CONTROL BATTERY/START BATTERY AMPS] = Record Number

[RPM] = DD (Day number) [TEMP] = HH (Hours – 24Hr)

[HOURS] = MM (Month) [AMPS] = MM (Minutes)

[OIL PRESSURE] = YYYY (year)[FUEL TANK LEVEL]= Seconds

2.n.4.2 Status View

The status displays the same as it was just after the event was logged.

o. DATA LOGGING

Logged data is saved to 32KB EEPROM

2.o.1 Status Log

The system logs a status record that contains

FIELD NUMBER	DESCRIPTION	NOTES
1	Record Number	
2	Date	YYMMDD
3	Time	HHMMSS
4	State of All Digital Input	Bitmapped
5	State of Indicators	Bitmapped
6	Engine Hours	
7	Engine RPM	
8	Oil Pressure	
9	Engine Temperature	
10	Alternator Amps	
11	Fuel Level	
12	State of Outputs	
	Control Battery Volts	FIRE SYSTEM ONLY
	Control Charger Amps	FIRE SYSTEM ONLY

	Start Battery Volts	
	Start Battery Charger Amps	
	Engine Start Processor State	
	Relays Operated	Bitmapped
	Flags	Bitmapped

A status record is logged every time any of the following happen.

1. Whenever a digital input or output changes state
2. When internal status flags are changed:-

BOOT
BAD_RPM_LIMITS
MUTE
LOW_FUEL_WARNING
OVERSPEED
AUTO_ISOLATED
LOW_WATER_PRESSURE
ENGINE_STABLE
ENGINE_CONTROLLER_FAILED_RESTART_LIMIT
ENGINE_CONTROLLER_COMMS_FAILED
SUPPLY_CRITICAL_ALARM
CONTROL_CHARGER_FAIL
CRANK_CHARGER_FAIL
MAINS_FAILED

ENGINE_SHUTDOWN

3. Every 1 hour
4. Every 1 minute when the pump is running or pressure switch is on
5. Whenever the unit is placed in configuration mode or returned to operating mode.

The unit can store 250 status records in a circular store. The last 250 records are kept with the oldest record being written over first.

2.o.2 Configuration Log

The system logs a configuration record containing a complete copy of the new configuration whenever a system is restarted after changing the configuration. The unit can store 50 configurations.

By keeping the configurations it is possible to know how the controller was configured at any time. This is useful for interpreting the status log.

BYTE NUMBER	FIELD	NOTES
0 .. 1	Record Number	
2 .. 5	Time & Date	32bit universal time
6 .. 57	Copy of all Main Processor Registers in section 4.7	

p. DIAGNOSTIC PORT

An RS232 port is available for Programming and Diagnostics and allows the following:-

(1) View and setting (where writable) Main Processor registers in 4.10.1
(2) Viewing and setting (where writable) Engine Start Processor registers via the Modbus protocol
(3) Download of the Logged data.
(4) Viewing the Current Status and Engine Instrumentation data.

It uses an ASCII protocol with a simple command set (see table below)

The port is set up with the following fixed serial parameters:-

Speed 115200 Baud
Data Bits 8
Parity None
Stop Bits 1
Handshake None

2.p.1 Passcode Access

The diagnostics port requires entry of a USER PASSCODE (Default is 2680) before can access functions.

NOTE: - this feature is NOT currently activated.

2.p.2 Commands

Commands are entered as ASCII Numeric Fields
The First field is the Command number
This is followed by 1 or 2 arguments as ASCII representing 16 bit signed integers
Fields are separated by space and line ends in <CR>

FUNCTION NUMBER	ARGUMENT 1	ARGUMENT 2	DESCRIPTION
1	Register Number		View Register 0..31 for Local Registers 32..43 for Engine Start Registers
2	Register Number	Value	Set Register 0..47 for Local Registers 48..59 for Engine Start Registers
3	Register Number		View Display Register
4	Register Number	Value	Set Display Register. Note – will need to be in test mode as value will be overwritten in normal mode
5			View Current Display Panel Data (Same format as Log data) CSV format
6	Record Number Start	Record Number End	Dump Status Log If Record number End =0 or not entered, then set to Last (most Current) record. Set the view record pointer to Record Number End
7	0=Current 1=Previous 2=Next		View Status Log Record at record pointer. In Test Mode then the display will also show the display status values for the logged record.
8	Record Number Start	Record Number End	Dump Configuration Log If Record number End =0 or not entered, then set to Last (most Current) record. Set the view record pointer to Record Number End If no arguments, then Dump ALL records
9	0=Current 1=Previous 2=Next		View Configuration Log Record at record pointer. In Test Mode then the display will also show the display status values for the logged record.

10			Dump Configuration Registers. See Note ** below
14			Read Clock
15	DD MM YY	HH MM SS	Set Clock Note – 24HR TIME
17			Show Calibration Values
18	A/d Register No		Display RAW a/d value
19	3781		Reset to Factory Default Parameters

2.p.3 Responses

All Responses (Except for command 10) are as follows:-
XXX (s) YYYYY
Where XXX is the Response Number = Command Number +100
(s) YYYYY is 1 to 5 digits representing the (signed) integer value
If a command has incorrect syntax or fields are out of range, then the invalid response is
255 NNN
Where NNN is the error number

ERROR NUMBER	DESCRIPTION
1	Invalid Command
2	First Argument Invalid
3	Second Argument Invalid
4	Both Arguments Invalid

2.p.4 Function 5 – View Current Status

The command 5 returns a comma separated (CSV) line showing the current status of the indicators, engine instrumentation and other internal parameters.
An example is as follows:-
105,42,3783620755,3456,64095186,1078,2981,0,999,0,0,0,202,0,0,0,3,2
The 18 fields shown are:-

FIELD	PARAMETER	DESCRIPTION
0	Response code (105)	
1	Record_number	Record Sequence number
2	Time	Time in universal time - Seconds since 0:00:00 0/0/2000
3	Digital_inputs	Bitmapped field – see 2.p.4.1
4	Indicators	Bitmapped field – see 2.p.4.2
5	Engine_hours	Engine Running time in seconds
6	Engine_rpm	Engine Speed

7	Engine_oil_pressure	Engine Oil Pressure - Kpa
8	Engine_temperature	Engine Temperature – DegC
9	Alternator_amps	Alternator Amps x 10
10	Engine_fuel_level	Fuel Level - %
11	Digital_outputs	Bitmapped field-
12	Control_battery_volts	Voltage x10
13	Control_battery_amps	Amps x10
14	Start_battery_volts	Voltage x10
15	Start_battery_amps	Amps x10
16	Engine_start_state	Engine Processor State – see 2.p.4.3
17	Relays	Bitmapped State for each of the VFC Relays
18	Flags	Main Process Flags – see 2.p.4.4

2.p.4.1 Digital Inputs – BITMAPPED Field

BIT POSITION	D13242 FUNCTION
P_DIN0	Not Used
P_DIN1	MUTE EXTERNAL J10
P_DIN2	CONTROL MAINS FAIL
P_DIN3	AUX INPUT J9
P_DIN4	CRANK MAINS FAIL
P_DIN5	AUX INPUT J8
P_DIN10	MANUAL CONTROL SWITCH
P_DIN11	MANUAL START SWITCH
P_DIN12	STOP
P_DIN13	FUEL SWITCH
P_DIN14	Not Used
P_DIN15	LOW PRESSURE

2.p.4.2 INDICATORS – BITMAPPED field

REFER TABLE e for further descriptions

Bit Position	LED Position	Function
0	D10	Pump Available
1	D11	Pump Running
2	D12	Auto Start Isolated
3	D13	Engine Fail to Start
4	D14	Low Fuel Level
5	D15	Engine Overspeed Shutdown
6	D16	High Engine Temperature
7	D28	Low Oil Pressure
8	D17	Control Battery Charger Fail

		(FIRE SYSTEM ONLY)
9	D18	Start Battery Low Voltage
10	D19	Control Battery Low Voltage (FIRE SYSTEM ONLY)
11	D20	Audible Alarm Muted
12	D21	System Low Water Pressure
13	D22	Water Supply Tank Low Level
14	D23	AUX 1
15	D29	Power Available
16	D30	AUX 2
17	D31	Start Battery Charger Fail

2.p.4.3 Engine Processor State

STATE NUMBER	ABBREVIATED	DESCRIPTION
0	STOPPED	Normal Idle State
1	WAIT_RESTART	
2	CRANKING	
3	RUN	
4	FORCED_STOP	
5	STOPPED_OVERSPEED	Alarm Condition –requires manual Alarm Reset
6	RESTART_LIMIT	Alarm Condition –requires manual Alarm Reset
7	MANUAL_STOP	

2.p.4.4 Main Process Flags

BIT POSITION	ABBREVIATED	DESCRIPTION
0	BOOT	The unit has been reset – Cleared with the first logged record
1	BAD_RPM_LIMITS	Engine Processor RPM Limits do not match the main processor RPM Limits
2	MUTE	Alarms are muted
3	SPARE1	
4	OVERSPEED	The unit is tripped out with overspeed
5	AUTO-ISOLATED	Unit is in auto-isolate mode
6	LOW FUEL WARNING	
7	LOW WATER PRESSURE	
8	ENGINE STABLE	
9	ENGINE CONTROLLER FAILED RESTART LIMIT	

10	ENGINE CONROLLER COMMS FAILED	
11	SUPPLY CRITICAL FAILURE	Loss of Mains for 4 Hours
12	CONTROL CHARGER FAILED	
13	CRANK CHARGER FAILED	
14	MAINS FAILED	
15	ENGINE SHUTDOWN	STOP/START system forced shutdown

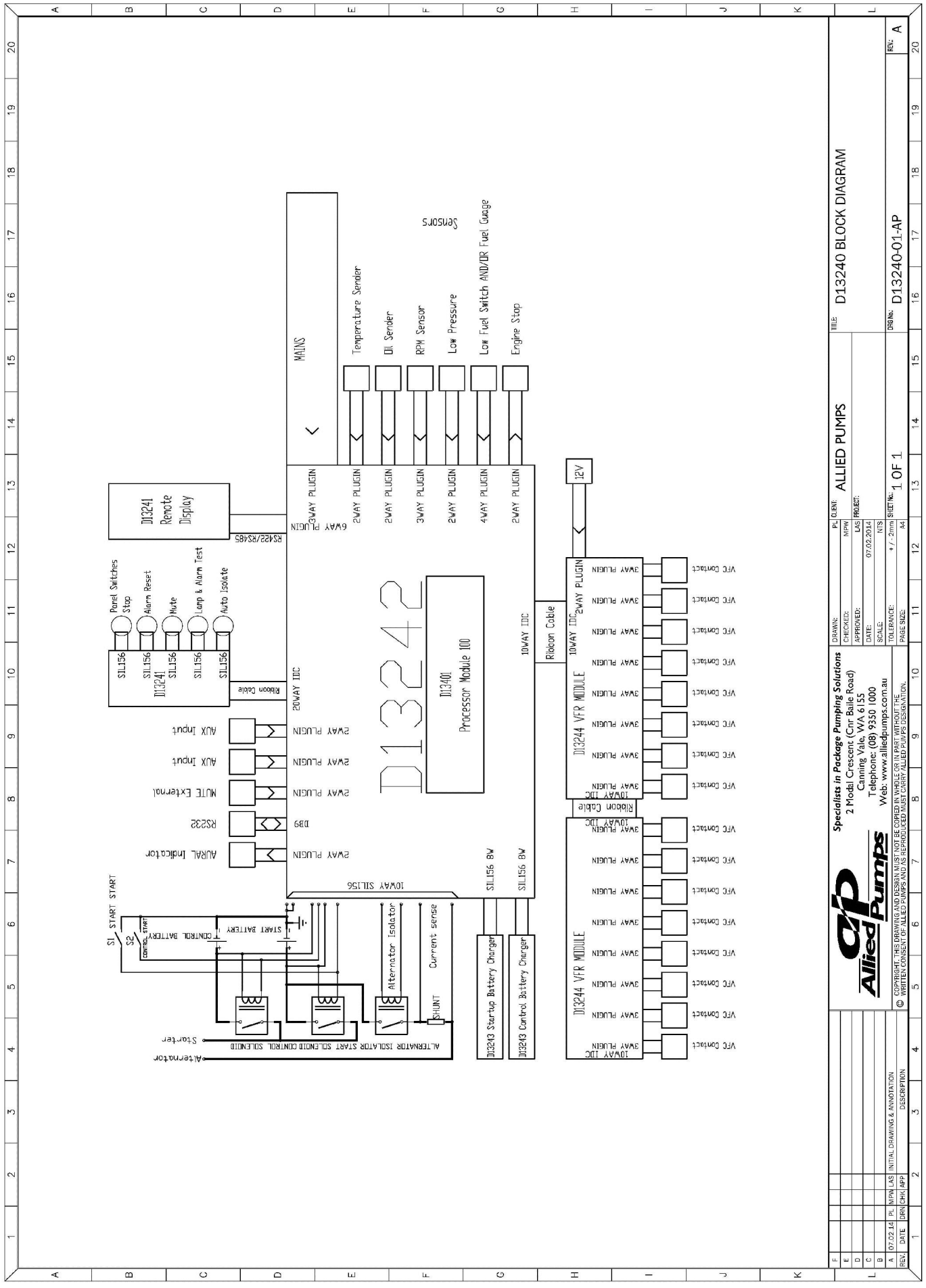
2.p.4.5 Digital Output

2.p.5 Configuration Register Dump

Note ** - The configuration Register Dump (Command 10) response should be in the following format:-
Example:

D1324 Register Dump (header 1)
dd/mm/yyyy hh:mm:ss (header 2)
2 0 13401 (first Local register)
2 1 12 (second register)
2 2 1
2 3 1
“ “ “
“ “ “
2 47 0 (last Local Register)
2 48 13241 (first Engine Start register 0)
“ “ “
“ “ “
2 59 0 (last Engine Start register 11)

The register fields are commenced each line with ‘2’
This allows the text to be captured to a file with Hyperterm
This file can then be modified and then sent back to the main processor


D13242
D13241 Remote Display
D13241
D13401 Processor Module 100
D13243 Startup Battery Charger
D13243 Control Battery Charger
D13244 VFR MODULE
D13244 VFR MODULE
MAINS
Temperature Sender
Oil Sender
RPM Sensor
Low Pressure
Low Fuel Switch AND/OR Fuel Gauge
Engine Stop
Sensors
Panel Switches
Stop
Alarm Reset
Mute
Lamp & Alarm Test
Auto Isolate
Ribbon Cable
Ribbon Cable
Ribbon Cable
AUX Input
AUX Input
MUTE External
RS232
AURAL Indicator
START BATTERY
CONTROL BATTERY
ALTERNATOR ISOLATOR START SOLENOID CONTROL SOLENOID
Alternator Isolator
Current sense
SHUNT
Starter
Alternator
Specialists in Package Pumping Solutions
2 Model Crescent (Cnr Baile Road)
Canning Vale, WA 6155
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CLIENT: ALLIED PUMPS
TITLE: D13240 BLOCK DIAGRAM
DRAWN: PL
CHECKED: MPW
APPROVED: LAS
DATE: 07.02.2014
SCALE: NTS
TOLERANCE: +/- .2mm
PAGE SIZE: A4
SHEET No: 1 OF 1
DRG No: D13240-01-AP
REV: A
A 07.02.14 PL MPW LAS INITIAL DRAWING & ANNOTATION
REV: DATE: DRN CHK APP DESCRIPTION

A

APENDIX A
Warranty and Service Information

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