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NFPA®

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NAFFCO UL LISTED DIESEL FIRE PUMP CONTROLLER

MICRO-PROCESSOR BASED

NOTE
The manual is divided into two sections,
Section 1: Containing Installation Operation and Maintenance instruction for Diesel Engine Controller with H.O.A selector switch.
Section 2: containing Installation Operation and Maintenance instruction Diesel Engine Controller with Direct Operation

SECTION 1

Installation Operation and Maintenance instruction for Diesel Engine Controller with H.O.A selector switch

1. Sequence of Operation

This controller is working under three modes; automatic, off (reset) and manual mode, with manual or automatic shut down (automatic shut down is possible only after automatic start).

Fig. No. 01

1.1. Off Mode

- In this mode starting diesel engine is not possible in any case.
- Automatic test and manual test are not operational.
- Alarm bell is not enabled in this mode, but alarm indicators are enabled.
- This mode also is used to shutdown the engine.

1.2. Manual Mode

- In this mode, there will be no effect of pressure sensor, deluge valve or remote start.
- Manual direct cranking can be actuated by pressing on battery 1 manual cranking P.B, or on battery 2 manu al cranking P.B, or by pressing on both (start from both batteries in parallel).
- Shutting down engine can only be done by pressing manual stop Push Button.
- Failed to start alarm signal are not operational in this mode, and all other alarm signals are operational.
- Over speed alarm is functional in this mode, and will stop the pump directly and automatically and actuate alarm, and controller will not start engine again unless operator resets the over speed relay at diesel engine, and then resets the Over Speed Alarm by pressing reset PB of the controller.
- Low oil pressure and high water temperature errors will not stop the diesel engine, but only will give alarm, and alarm will remain until operator resets it by pressing reset PB.
- This mode also is used to shutdown the engine.

1.3. Automatic Mode

- In this mode, if pressure goes down till the cut-in pressure point then diesel engine will start automatically.
- If the N/C contact of the deluge valve was opened, this will cause the pump to start automatically exactly as if the pressure goes down to starting pressure.
- In case of multiple pumps, it may be necessary to delay the starting of each engine to prevent simultaneous starting of all engines. Sequential starting can be adjusted by a programmable timer (1 – 99 seconds). User has to specify whether the pump is connected as single/parallel with other pumps, or if the pump is connected in series with other pumps (programmable). In the first case (single or parallel), system will apply time delay before automatic start (by water pressure or deluge valve), but starting by remote start will not be delayed. In the second case (series), system will apply time delay before automatic start (by water pressure or deluge valve), and also before starting by remote

start, and this is to avoid dry running of pump (below table).

TIME DELAY BEFORE STARTING THE PUMP		
REASON OF STARTING	SINGLE PUMP OR PARALLEL PUMPS	SERIES PUMPS
Drop in Pressure	With Delay	With Delay
Deluge Valve	With Delay	With Delay
Remote Start	No Delay	With Delay

- If remote start switch was momentary actuated, the diesel engine will start directly and automatically, and it will not stop unless operator presses stop push button on the panel's door. In this mode (remote start mode) there will be no effect of the low oil pressure alarm, high water temperature alarm, and also will be no effect of deluge valve signal and low pressure signal.
- Engine automatic start by pressure sensor and deluge valve can be disabled by pump lockout contact (external contact) which can be connected with controller (this option can be used in case of having a stand-by pump, where it is not desired both pumps to start automatically at the same time).
- Automatic starting for the diesel engine will be done by automatic cranking from battery 1, and if failed from battery 2, with certain cranking and rest period (period is programmable). Controller will try to crank engine up to six times, but if engine did not start after these six attempts, "Failed To Start Alarm" will be activated, as shown in fig (2):

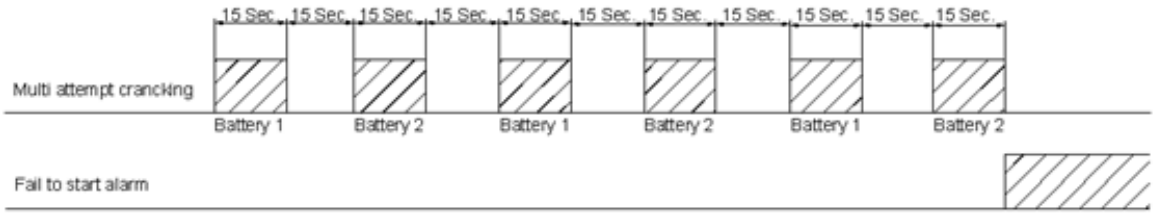


Fig. No. 02

- If one of the batteries was dead or disconnected, the controller will automatically crank all six attempts from the healthy battery and ignore the dead battery.

- Two ways of shutdown are possible in this mode (operator have to select one of them from the software):

1. Manual shutdown: After automatic start, engine can be stopped in this mode only by pressing manual stop push button, but engine can't be stopped if the pump was still on demand (pressure still low or deluge valve still active), unless user put the switch on OFF position.

2. Automatic shutdown: After automatic start, controller will keep engine running for a period varies from 1 to 120 minutes (programmable). After that, if the pump was not any more on de-

mand, then controller will automatically shutdown the engine. If within this period, the pump became not on demand, operator can shut it down manually by pressing manual stop push button.

METHOD OF STOPPING THE FIRE PUMP		
REASON OF STARTING	**Automatic Stop**	**Manual Stop**
Drop in Pressure	Yes - Selectable (After running hold time)	Yes - Selectable
Deluge Valve	Yes - Selectable (After running hold time)	Yes - Selectable
Remote Start	No	Yes
Manual Start	No	Yes

- When the engine is running because the pump being on demand (due to low pressure or activation of deluge valve or remote start), it will not stop if there was high water temperature alarm, or low oil pressure alarm, but if it was running and the reason of starting has gone then it will directly stop if any of these two alarms was activated, and alarm will remain until operator resets it by pressing reset PB.
- In this mode (auto), operator can't start the diesel engine by the manual cranking push buttons.
- Over speed alarm is functional in this mode, and will stop the pump directly and automatically and actuate alarm, and controller will not start engine again unless operator resets the over speed relay at diesel engine, and then resets the Over Speed Alarm by pressing reset PB of the controller.
- All alarm signals are operational in auto mode.
- Automatic weekly test is only operational at auto mode and can be enabled or disabled (operator selection). If enabled, then user has to program the delay time before starting the test. Also to program the day, hour and minute where the weekly automatics test is desired to start. Test can be terminated by pressing Test ON/OFF push button.
- Manual test is operational in auto mode only, and it can be applied by pressing test ON/OFF push button. Test can be terminated by pressing Test ON/OFF push button again.

2. Compatibility with fuel solenoids engines and with stopper solenoids engines:

NFY-DM1 controller can be connected with engines that can be stopped by stopper solenoid or by fuel solenoid and it works as the following:

- In OFF mode, controller will directly stop the engine by activating the stopper solenoid for some seconds (programmable), and by deactivating the fuel solenoid. After this time delay, engine should be completely stopped.
- In Manual mode, controller will be always activating fuel solenoid to keep engine ready for running. If the engine was running in this mode and then manually stopped, then (same as OFF mode), controller will directly stop the engine by activating the stopper solenoid for some seconds (programmable), and by deactivating the fuel solenoid.

After this time delay, engine should be completely stopped. After that controller will activate back the fuel solenoid to keep engine ready for running again.

- In Automatic mode, controller will not activate any solenoid if pump was not on demand, but when pump becomes on demand (engine to run), controller will activate fuel solenoid to allow engine to crank and run. And after running, if engine has got to stop, then controller will do the same stopping sequence as in OFF mode above.

3. Electronic Controller YH-D-M1:

Fig. No. 03

4. YH-D-M1 Hardware

- YH-D-M1 is an electronic mother board designed to be installed in NFY-DM1 control panel. It is programmed to apply certain functions to control a diesel engine connected with fire pump. This engine fire pump duty is to maintain high pressure in the discharge pipe, so as all the water network will be pressurized (pressure value is programmable); See Fig 3:
- YH-D-M1 has an alphabetic 20 x 4 LCD and a key board, showing system status, records and events, and also allows user to program the system; see Fig 2.
- Has 26 digital inputs; 15 inputs are necessary for the basic functions of controllers, the remaining 11 are auxiliary and programmable.
- Sensing 5 analog signals; two DC voltage signals for monitoring batteries voltages, two DC current signals for monitoring batteries charging currents, and pressure transducer signal, which should be connected by a pipe with fire pump discharge line.
- Has a USB port, to save pressure and events records to an external USB memory, and data files can be viewed by windows software such as MS word and Excel.

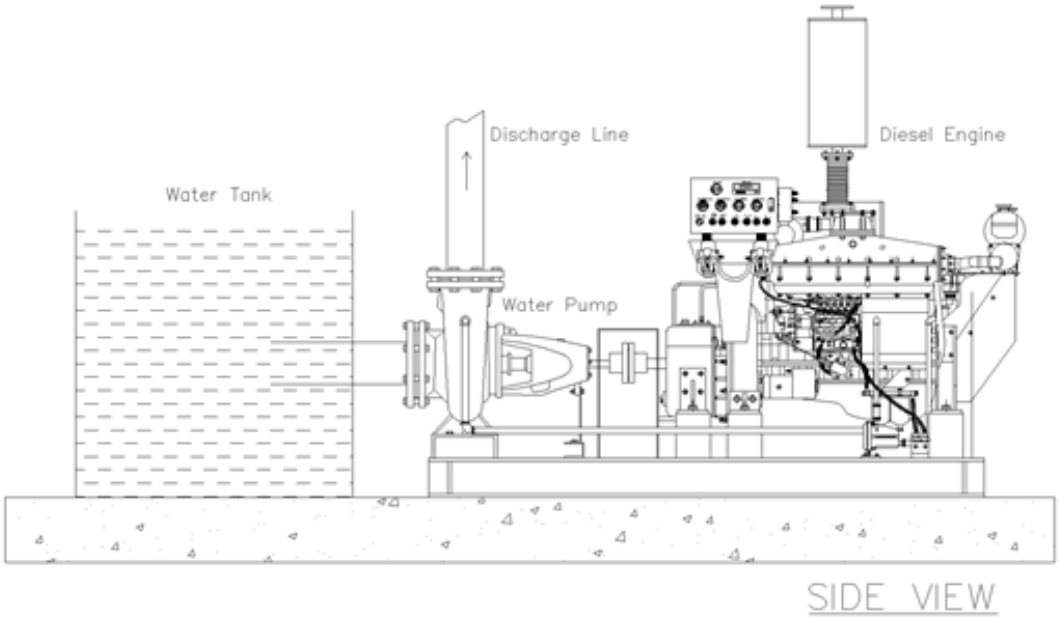


Fig. No. 03

5. YH-D-M1 Software Structure

YH-D1-M1 controller is programmed to control operation of diesel engine of fire pump according to NFPA20 standard. This controller has 8 keys (push buttons) to enable user to go through the software and program controller's parameters and configure all settings as per required. These keys are:

Enter/Save:

This key is used for the following:

- To enter from main screen to branch screen.
- To save data after making changes on parameters or settings.
- To save data to USB memory when the display is on the log mode.

Esc/Reset:

This key is opposite to ENTER key, and used to go from branch screen to main screen. Also it is used to reset the alarms.

Go Up/Down:

These two keys are used for:

- Increasing/decreasing the entered value (number).
- Moving to the next/previous screen.

Go right:

This key is to shift the cursor between digits while entering value of parameter.

System Logs:

This key is to go to screens of system logs: pressure log, and events/alarms log.

Test On/Off:

This key is for:

- Starting the manual test.
- Stopping the manual test.
- Stopping the automatic test.

Alarm Silence:

This key is to mute alarm (only secondary alarms or events).

6. Event and Alarms

YH-D-M1 consists of fixed and programmable events/alarms to give wide range of flexibility and to cover all user's requirements and needs. This can be seen in the following table:

Status	Alarm/Event	Audio	Indicator	Free Contact
Main	Low Oil Press	Yes	Yes	Yes
	High Water Temp	Yes	Yes	
	Failed to Start	Yes	Yes	
	Over Speed Shutdown	Yes	Yes	
	Battery 1 Failure	Yes	Yes	

Main	Battery 2 Failure	Yes	Yes	Yes (Common)
	Charger 1 Failure	No	Yes	
	Charger 2 Failure	No	Yes	
	Cranking Coil 1 Failure	Yes	Yes	
	Cranking Coil 2 Failure	Yes	Yes	
	Low Fuel	Yes	Yes	
	Fail While Running - Speed Switch Error	Yes	Yes	
	System Error	Yes	Yes	
	Test On	Programmable	Yes	Programmable
	Auto Test Mode	No	Yes	No
	Auto Shutdown Mode	No	Yes	No
	Engine Run	No	Yes	Yes
	AC Power Failure	Programmable	Yes	Programmable
	DC Power Failure	Yes	Yes	Yes (Fail Safe)
	Pump Lockout	No	Yes	Yes
	Manual Mode	No	Yes	No
Additional	Auto Mode	No	Yes	Yes
	Low Discharge Pressure	Programmable	Programmable	Programmable
	Deluge Valve On	Programmable	Programmable	Programmable

Additional	Remote Start	Programmable	Programmable	Programmable
	Auxiliary 1	Programmable	Programmable	Programmable
	Auxiliary 2	Programmable	Programmable	Programmable
	Auxiliary 3	Programmable	Programmable	Programmable
	Auxiliary 4	Programmable	Programmable	Programmable
	Auxiliary 5	Programmable	Programmable	Programmable
	Auxiliary 6	Programmable	Programmable	Programmable
	Auxiliary 7	Programmable	Programmable	Programmable
	Auxiliary 8	Programmable	Programmable	Programmable
	Auxiliary 9	Programmable	Programmable	Programmable
	Auxiliary 10	Programmable	Programmable	Programmable
	Auxiliary 11	Programmable	Programmable	Programmable

- Low oil pressure: This event will be activated when the engine oil pressure is low (oil pressure switch activated).
- High water temperature: Will be activated when the coolant water temperature becomes high (water temperature switch activated).
- Fail to start: Will be activated when the system is on automatic mode, and the engine tries to start the engine by multi cranking. After the six attempt fail then this alarm will be activated.
- Over speed shutdown: This alarm will be activated when the over speed switch (located in the engine instrument panel), gives an over speed signal, and this signal can't be reset before resetting the over speed switch.
- Battery 1 / 2 failure: Will be activated when battery 1 / 2 is dead or disconnected.
- Charger 1 / 2 failure: Will be activated when charger 1 / 2 is facing error

- Cranking coil 1 / 2 failure: Will be activated when there is an open circuit or disconnection in cranking coils.
- Low fuel level: Will be activated when the fuel switch is activated because of low fuel in diesel fuel tank.
- Failed while run - Speed switch error: This alarm will be activated if there is a loss of signal from the speed switch during engine running, and this might be due to 3 reasons; either engine stopped, or speed sensor/ transducer is malfunctioning or the speed switch itself is not working properly.
- System Error: This alarm will be activated when relay board parallel cable is disconnected, or when MCU stops, or when there is power loss in mother board, or when memory card is removed or not installed or mall functioning.
- AC power healthy: Will be on when the AC power is normal and connected.
- DC power healthy: Will be on when the DC power feeding the electronic board is normal.
- Automatic mode: Active when system is on auto mode.
- Manual mode: Active when system is on Manual mode.
- Automatic shutdown mode: Active when automatic shutdown enabled.
- Automatic test enabled: Active when the automatic weekly test is enabled.
- Test ON: Active when test (automatic or manual) is on (Running).
- Pump Lockout: Active when lockout switch is activated.

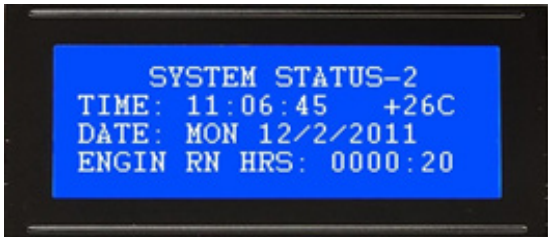
7. Program displays and settings

7.1. Main display

In normal conditions, LCD shows 2 main displays:

- Pressure / battery.
- Time/date/running hours display.

User can shift between these 2 displays by pressing any of UP and DOWN keys.



7.2. System logs

This level is to show user all recorded data, and user can go to this level by pressing on SYSTEM LOGS key. In this level there are two displays; pressure log and events/alarms log, and user can shift between these two displays by up and down keys.

- In PRESSURE logs, system shows pressure value, pump run, pump stop, with date and time.
- In EVENT/ALARM logs, system shows any events happened (refer to event and alarms table) with date and time.

If user requires saving the logged data to USB memory, he should go to the required display (pressure logs for example), then press ENTER/SAVE key. To get out of this level and go back to main display, user shall press ESC key. The saved data in USB will be stored in a file, which can be opened with Windows programs such as MS Word and Excel. It will be in the following formats:

Pressure Logs format :

PRESSURE LOG	VER 1.0		
DATE	TIME	PRESSURE (PSI)	PUMP STATUS
23/01/2011	17:14:38	279	ENGINE STOP
23/01/2011	17:14:53	150	ENGINE STOP
23/01/2011	17:15:08	90	ENGINE RUN
23/01/2011	17:15:23	80	ENGINE RUN
23/01/2011	17:15:38	85	ENGINE RUN

7.3. Event / Alarm Logs format

Event / Alarm Log	VER 1.0		
DATE	TIME	PRESSURE (PSI)	PUMP STATUS
16/01/2011	16:21:16	System Booting	OCCURRED
16/01/2011	16:21:16	AC Power failure	OCCURRED
16/01/2011	16:21:16	Cranking Coil1 failure	OCCURRED
16/01/2011	16:21:16	Cranking Coil2 failure	OCCURRED
16/01/2011	16:21:16	Battery1 failure	OCCURRED
16/01/2011	16:21:51	Low Pressure	OCCURRED
16/01/2011	16:21:51	System Booting	OCCURRED
16/01/2011	16:21:52	AC Power failure	CLEARED

Note: Logging rate will be selected from SETTINGS AND PARAMETERS (refer system configuration).

7.4. System Configuration

User can enter this level by pressing ENTER key; system will ask user to enter password (default oooo).

If password is entered correctly then system will enter to three main levels: SETTINGS AND PARAMETER, EVENTS and AUXILIARY INPUTS (user can shift between theses three levels by UP/DOWN keys, then press ENTER to get into the selected one:

7.5. Settings and Parameters

When user is in this level, he must press ENTER to go into sub levels. The following sub levels will appear and user can shift between them by pressing UP/DOWN keys (default values of system parameters can be seen between brackets [ ]), and user has to press ENTER again to go into the selected sub level to change the values of parameters. After changing parameters, user must press ENTER to save the new value. These sub levels are:

- LCD backlight mode: This screen is to choose whether to keep LCD always on or to become off after 5 min from last key pressed. User can see the choices and the default value on this display.

- To Adjust Day

- To Adjust Local Date

- To Adjust Local Time

- Max Transducer Pressure: To enter the maximum rated pressure measured by the transducer.

- Pressure sensor volt: To enter the output voltage of the pressure Transducer. (Controller uses analog voltage output transducers; either 5 or 10 VDC).

- Engine Start pressure: To enter pressure value that causes engine to start automatically.

• Engine Stop pressure: To enter pressure value that causes engine to stop automatically (when pressure reach this point, pump will be no more on demand). User should avoid making start and stop pressure same – there should be enough pressure difference.

• Low pressure set time: To enter duration of low pressure, where after it system will consider that low pressure event has occurred and will take decision to start the pump (this to avoid effect of any transient fast drops in pressure).

• Low pressure reset time: To enter duration of high pressure, where after it system will consider that low pressure event has cleared. (This to avoid effect of any transient fast increase in pressure).

• Engine Start delay: This screen is to enter delay time in seconds before starting engine. This feature is mostly used with multi pumps starting.

- Cranking time: This screen is to adjust the cranking time of engine (also the rest time between two cranking).

- Pump in Single/Parallel: To select if pump is single/parallel or in series with other pumps.

- Deluge valve: To enable or disable effect of deluge valve.

- Automatic shutdown mode: To enable or disable automatic shut down mode.

- Stopper / fuel solenoid stop holding time: This screen is to enter the stopping holding time (holding time to keep stopper solenoid active and fuel solenoid inactive to make sure engine is stopped).

- Engine run holding time before auto stop: To enter the minimum duration of engine running after automatic start.

- Battery Alarm Voltage: To enter voltage value that causes battery alarm to start.

- Automatic test: To enable or disable weekly automatic test of engine.

- Auto test start delay: To enter time delay before starting automatic test (free contact will not be included in this delay if used, but only drainage solenoid valve activation will be delayed). This delay is mostly used to enable system to give remote alarm signal to guard room before starting, so as guard can attend testing.

- Automatic test day: To enter day of automatic test, so as the test will start once every week in this day.

- Automatic test time: To enter time of automatic test.

- Auto test run holding time: To enter the minimum duration of automatic test (minimum duration of activating of drainage solenoid valve).

- Auto test run holding time: To enter the minimum duration of automatic test (minimum duration of activating of drainage solenoid valve).

- Time between pressure log samples: To enter time between recorded pressure readings.

- Change user password: To change user password.

- Reset Engine Run: To reset engine running hours counter to zero.

- Change to factory defaults: To change all setting back to factory default settings.

- Erase all system logs: To erase all recorded data of systems logs in the SD card.

7.6. Events

This level is to program the additional events only (main events / alarms are already programmed and can't be changed). User can program three main actions for each event; audio alarm, LED indicator, and free contact. Some of these actions are not applicable with some events (Refer the event aand alarm table). YH-D-M1 controller has 10 programmable extra indicator (LED), and 9 programmable extra output relays. These events are:

- AC power healthy.
- Low Discharge Pressure.
- Deluge Valve On.
- Remote start On.
- Test On (LED is not programmable – fixed).

Note: user can program certain LED or certain output relay with more than one event/alarm (to be as common LED / common relay).

Example of programming one of these events (Low discharge pressure):

- Low discharge pressure audio: To enable/disable audio signal with this event.

- Low discharge pressure LED: To select LED number that will be activated with this event (0 means no LED is selected).

- Low discharge pressure out relay [0], (0 – 8): To select output relay number that will be activated with this event (0 means no output relay is selected).

7.7. Auxiliary Inputs

This level is to program additional 11 auxiliary inputs. User can program three main actions for each auxiliary alarm; audio signal, indicator (LED) and free contact. System has 10 programmable extra indicator (LED), and 8 programmable extra output relays.

Example of programming one of these auxiliary inputs (Auxiliary input 1):

- Aux input_1 audio: To enable/disable audio signal with this input.

- Aux input_1 LED: To select LED number that will be activated with this input (0 means no LED is selected).

- Aux input_1 out relay: To select output relay number that will be activated with this input (0 means no output relay is selected).

8. YH-D-R1 HARDWARE

YH-D-R1 is a relay board designed to be connected with YH-D-M1 mother board. It contains of 20 output relay; 12 fixed alarms/events relays and 8 auxiliary programmable relays. The board has also 20 LED with the relays, to show the activated ones.

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NOTE
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Section 1: Containing Installation Operation and Maintenance instruction for Diesel Engine Controller with H.O.A selector switch.
Section 2: containing Installation Operation and Maintenance instruction Diesel Engine Controller with Direct Operation

SECTION 2

Installation Operation and Maintenance instruction for Diesel Engine Controller with Direct Operation

NAFFCO NFY Series Diesel Fire Pump Controller are designed to operate Diesel Engine driven fire pumps based on a pressure variation in the fire protection system. The controller is intended to control the Diesel Engine.

Fig. No. 01

CONTROLLER RATING

- 220 / 110 VAC main line system power.
- 12 / 24 VDC system control voltage

MODEL NAME CLASSIFICATION

MODEL NAME SAMPLE : NFY-DM1-230-50-12

NFY	DM1	230	50	12
MODEL SUFFIX	TYPE OF CONTROLLER	VOLTAGE	FREQUENCY	SYSTEM CONTROL VOLTAGE

1. SEQUENCE OF OPERATION

This controller is working under three modes; automatic and manual mode with manual or automatic shut down (automatic shut down is possible only after automatic start).

1.1. MANUAL MODE

- **START:** Manual direct cranking can be actuated by pressing on **battery 1 manual cranking push button**, or on **battery 2 manual cranking Push button**, or by pressing on both (start from both batteries in parallel).
- There will be no effect of pressure sensor, deluge valve or remote start in this mode.
- **STOP:** Shutting down engine can only be done by pressing manual stop push button.
- **ALARMS:** Failed to start alarm signal are not operational in this mode, and all other alarm signals are operational.

1.2. AUTOMATIC MODE

- **PRESSURE DROP:** In this mode, if pressure goes down till the cut-in pressure point then diesel engine will start automatically.
- **DELUGE VALVE:** If the N/C contact of the deluge valve was opened, this will cause the pump to start automatically exactly as if the pressure goes down to starting pressure.
- In case of **multiple pumps**, it may be necessary to delay the starting of each engine to prevent simultaneous starting of all engines. Sequential starting can be adjusted by a programmable timer (1 – 99 seconds). User has to specify whether the pump is connected as single/parallel with other pumps, or if the pump is connected in series with other pumps (programmable). In the first case (single or parallel), system will apply time delay before automatic start (by water pressure or deluge valve), but starting by remote start will not be delayed. In the second case (series), system will apply time delay before automatic start (by water pressure or deluge valve), and also before starting by remote start, and this is to avoid dry running of pump (below table).

TIME DELAY BEFORE STARTING THE PUMP		
REASON OF STARTING	**SINGLE PUMP OR PARALLEL PUMPS**	**SERIES PUMPS**
Drop in Pressure	With Delay	With Delay
Deluge Valve	With Delay	With Delay
Remote Start	No Delay	With Delay

Table. No. 01

- **REMOTE START:** If remote start switch was momentary actuated, the diesel engine will start directly and automatically, and it will not stop unless operator presses stop push button on the panel's door. In this mode (remote start mode) there will be no effect of the low oil pressure alarm, high water temperature alarm, and also will be no effect of deluge valve signal and low pressure signal.

- **PUMP LOCKOUT CONTACT**: Engine automatic start by pressure sensor and deluge valve can be disabled by pump lockout contact (external contact) which can be connected with controller (this option can be used in case of having a stand-by pump, where it is not desired both pumps to start automatically at the same time).
- **CRANKING ATTEMPT:** Engine will start by first cranking from battery 1, then from battery 2 if not successful on battery 1 , with certain cranking and rest period (delay time which is programmable). Controller will try to crank engine up to six times (3 from each battery), and "Failed To Start Alarm" will be activated if engine did not start after these six attempts, as shown in Fig (2):

» If one of the batteries was dead or disconnected, the controller will automatically crank all six attempts from the healthy battery and ignore the dead battery.

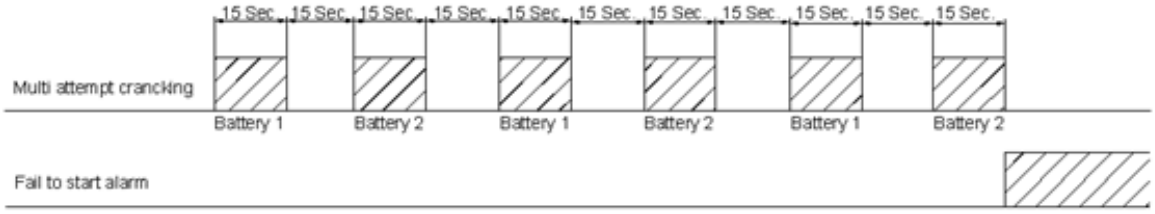


Fig. No. 02

- **SHUT DOWN :** Two ways of shutdown are possible in this mode (operator have to select one of them from the software):

» **Manual shutdown on Auto-mode :** After automatic start, engine can be stopped only by pressing **Manual Stop Push Button**, but engine can't be stopped if the pump is still on demand (pressure still low or deluge valve still active).

» **Automatic shutdown:** After automatic start, controller will keep engine running for a period varies from 1 to 120 minutes (programmable). If the pump is not any more on demand after delay time, the controller will automatically shut down the engine. If pump becomes not on demand within this delay time, operator can shut it down manually by pressing manual **stop push button**.

METHOD OF STOPPING THE FIRE PUMP		
Reason of Staring	**Automatic Stop**	**Manual Stop**
Drop in Pressure	Yes - Selectable (After running hold time)	Yes - Selectable
Deluge Valve	Yes - Selectable (After running hold time)	Yes - Selectable
Remote Start	No	Yes
Manual Start	No	Yes

Table. No. 02

1.3. ALARM CASES

- All alarm signals are operational in auto mode.
- Failed to start alarm signal are not operational in manual mode, but all other alarm signals are operational in manual mode.
- Pump **STOP** automatically in **OVER SPEED ALARM** cases and trigger alarm in both Auto mode and Manual mode. Also controller will not start the engine again unless operator **resets the over speed relay on diesel engine instrument panel** followed by resets the O**ver Speed Alarm** by pressing **RESET PUSH BUTTON** on the controller.

1.4. TEST THE ENGINE

- **AUTOMATIC WEEKLY TEST** is only operational in auto mode and can be enabled or disabled (operator selection). If enabled, the user has to program the delay time, test day, hour and minute. Test can be terminated by pressing Test ON/OFF push button.
- **Manual test** is operational in auto mode only, and it can be applied by pressing test ON/OFF push button. Test can be terminated by pressing Test ON/OFF push button again.

3. COMPATIBILITY WITH FUEL SOLENOIDS ENGINES AND WITH STOPPER SOLENOIDS ENGINES:

NFY-DM1 controller can be connected with engines that can be stopped by stopper solenoid or by fuel solenoid and it works as the following:

- In both **Automatic Mode** and **Manual Mode**, controller will not activate any solenoid if pump neither on demand nor cranking manually, but when pump becomes on demand/cranking manually (engine to run), controller will activate fuel solenoid to allow engine to crank and run. For stopping, the controller will stop the engine by activating the stopper solenoid for some seconds (programmable), and by deactivating the fuel solenoid.

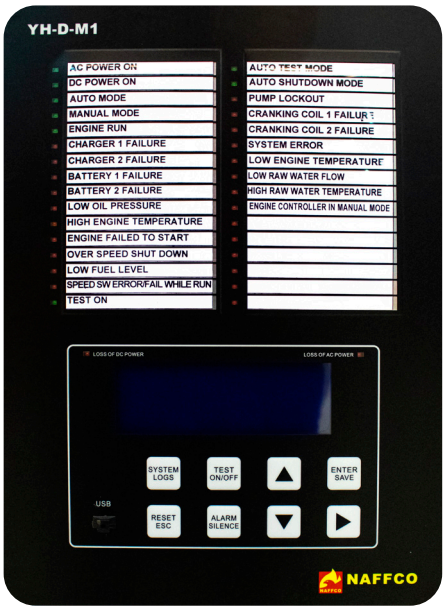


Fig. No. 03

CONTROLLER YH-DM1 FRONT PANEL

4. YH-D-M1 HARDWARE

- YH-D-M1 is an electronic mother board designed to be installed in NFY-DM1 control panel. It is programmed to apply certain functions to control a diesel engine connected with fire pump. This engine fire pump duty is to maintain high pressure in the discharge pipe, so as all the water network will be pressurized (pressure value is programmable); See Fig 4:
- YH-D-M1 has an alphabetic 20 x 4 LCD and a key board, showing system status, records and events, and also allows user to program the system; see Fig 3.
- Has 26 digital inputs; 15 inputs are necessary for the basic functions of controllers and there are auxiliary and programmable inputs too.
- Sensing 5 analog signals; two DC voltage signals for monitoring batteries voltages, two DC current signals for monitoring batteries charging currents, and pressure transducer signal, which should be connected by a pipe with fire pump discharge line.
- Has a USB port, to save pressure and events records to an external USB memory, and data files can be viewed in software such as MS word and Excel.

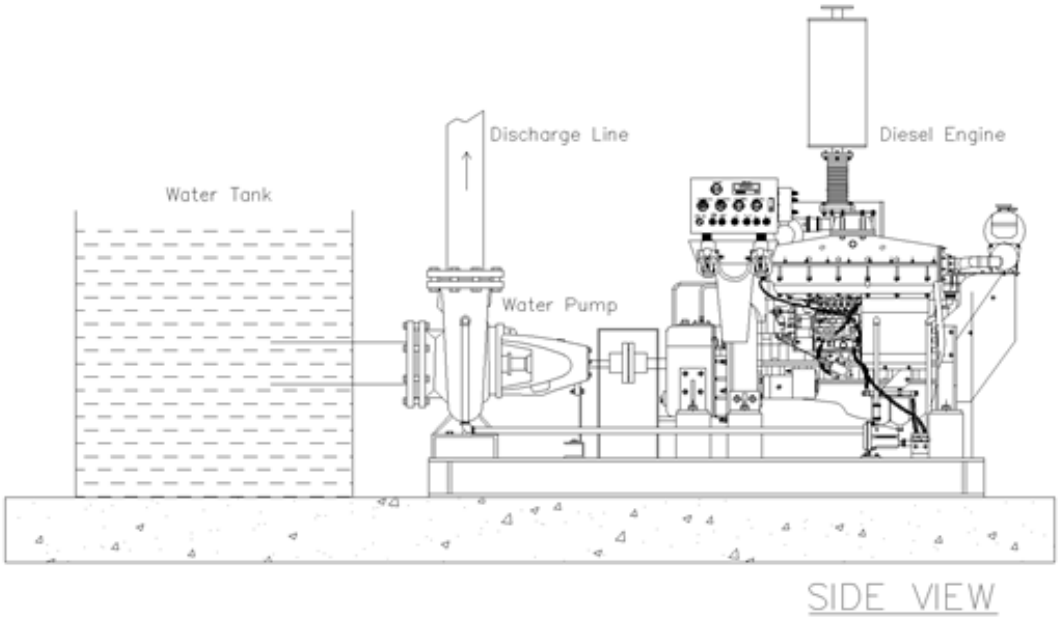


Fig. No. 04

5. YH-D-M1 SOFTWARE STRUCTURE

YH-D1-M1 controller is programmed to control operation of diesel engine of fire pump according to NFPA20 standard. This controller has 8 keys (push buttons) to enable user to go through the software and program controller's parameters and configure all settings as per required. These keys are:

Controller Keys	*Description*
ENTER / SAVE	This key is used for the following: • To enter from main screen to branch screen. • To save data after making changes on parameters or settings. • To save data to USB memory when the display is on the log mode.
RESET / ESC	This key is opposite to ENTER key, and used to go from branch screen to main screen. Also it is used to reset the alarms.
▲ ▼	These two keys are used for: • Increasing/decreasing the entered value (number). • Moving to the next/previous screen.
▶	This key is to shift the cursor between digits while entering value of parameter.
SYSTEM LOGS	This key is to go to screens of system logs: pressure log, and events/alarms log.
TEST ON / OFF	This key is for: • Starting the manual test. • Stopping the manual test. • Stopping the automatic test.
ALARM SILENCE	This key is to mute alarm (only secondary alarms or events).

6. EVENT AND ALARMS

YH-DM1 consists of fixed and programmable events/alarms to give wide range of flexibility and to cover all user's requirements and needs. This can be seen in the following table:

Status	Alarm / Event	Audio	Indicator	Free Contact
Main	Low Oil Press	Yes	Yes	Yes (Common)
	High Engine Temperature	Yes	Yes	
	Failed to start	Yes	Yes	
	Over Speed shutdown	Yes	Yes	
	Battery 1 failure	Yes	Yes	
	Battery 2 failure	Yes	Yes	
	Charger 1 failure	No	Yes	
	Charger 2 failure	No	Yes	
	Cranking coil 1 failure	Yes	Yes	
	Cranking coil 2 failure	Yes	Yes	
	Low Fuel	Yes	Yes	
	Fail while running - Speed switch error	Yes	Yes	
	System Error	Yes	Yes	
	Test On	Programmable	Yes	Programmable
	Auto Test Mode	No	Yes	No
	Auto Shutdown Mode	No	Yes	No
	Engine Run	No	Yes	Yes
	AC Power Failure	No	Yes	Programmable
	DC Power Failure	Yes	Yes	Yes (Fail Safe)
	Pump Lockout	No	Yes	Yes
	Manual Mode	No	Yes	No
	Auto mode	No	Yes	Yes
Additional	Low Discharge Pressure	Programmable	Programmable	Programmable
	Deluge Valve On	Programmable	Programmable	Programmable
	Remote Start	Programmable	Programmable	Programmable
	Low Engine Temperature	Programmable	Programmable	Programmable
	Low Raw Water Flow	Programmable	Programmable	Programmable
	High Raw Water Temperature	Programmable	Programmable	Programmable
	Engine Controller - Manual Mode	Programmable	Programmable	Programmable
	Auxiliary 1	Programmable	Programmable	Programmable
	Auxiliary 2	Programmable	Programmable	Programmable
	Auxiliary 3	Programmable	Programmable	Programmable
	Auxiliary 4	Programmable	Programmable	Programmable
	Auxiliary 5	Programmable	Programmable	Programmable
	Auxiliary 6	Programmable	Programmable	Programmable
	Auxiliary 7	Programmable	Programmable	Programmable

Table. No. 03

Event	Description
Low Oil Pressure	This event will be activated when the engine oil pressure is low (oil pressure switch activated).
High Engine Temperature	Will be activated when the coolant water temperature becomes high (water temperature switch activated).
Fail to Start	Will be activated when the system is on automatic mode, and the engine tries to start the engine by multi cranking. After the six attempt fail then this alarm will be activated.
Over speed shutdown	The over speed switch (located in the engine instrument panel), gives an over speed signal alarm and this signal can't be reset before resetting the over speed switch
Battery 1 / 2 failure	Will be activated when battery 1 / 2 is dead or disconnected.
Charger 1 / 2 failure	Will be activated when charger 1 / 2 is facing error
Cranking coil 1 / 2 failure	Will be activated when there is an open circuit or disconnection in cranking coils.
Low fuel level	Will be activated when the fuel switch is activated because of low fuel in diesel fuel tank.
Failed while run - Speed Switch Error	This alarm will be activated if there is a loss of signal from the speed switch during engine running, and this might be due to 3 reasons; either engine stopped, or speed sensor/transducer is malfunctioning or the speed switch itself is not working properly.
System Error	This alarm will be activated when relay board parallel cable is disconnected, or when MCU stops, or when there is power loss in mother board, or when memory card is removed or not installed or mall functioning.
AC power healthy	Will be on when the AC power is normal and connected.
DC power healthy	Will be on when the DC power feeding the electronic board is normal
Automatic mode	Activates when system is on auto mode.
Manual mode	Activates when system is on Manual mode.
Automatic shutdown mode	Activates when automatic shutdown enabled.
Automatic test enabled	Activates when the automatic weekly test is enabled.
Test On	Activates when Test (automatic or manual) is on (Running)
Pump Lockout	Activates when the lockout switch is activated
Low Engine Temperature	Activates when the engine temperature (coolant water temp) goes below set point
Low Raw Water Flow	Activates when the Raw water flow goes below set point (pressure)
High Raw Water Temperature	Activates when the Raw water Temperature goes below set temperature.
Engine Controller - Manual mode	Activates when the engine instrument panel changes to manual mode.

All other auxiliary alarms and events are programmable as shown in table 3.

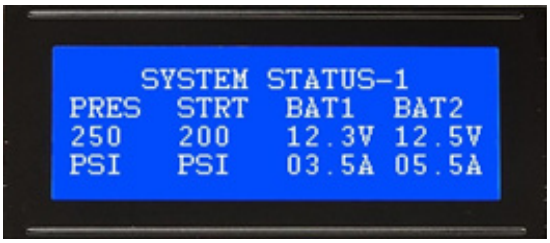
7. PROGRAM DISPLAYS AND SETTINGS

7.1. MAIN DISPLAY

In normal conditions, LCD shows 2 main displays:

- Pressure / battery.
- Time/date/running hours display.

User can shift between these 2 displays by pressing any of UP and DOWN keys.



7.2. SYSTEM LOGS

This level is to show user all recorded data, and user can go to this level by pressing on SYSTEM LOGS key. In this level there are two displays; pressure log and events/alarms log, and user can shift between these two displays by up and down keys.

- In PRESSURE logs, system shows pressure value, pump run, pump stop, with date and time.
- In EVENT/ALARM logs, system shows any events happened (refer to event and alarms table) with date and time.

SAVE / COPY DATA TO USB FLASH DRIVE : If user requires saving the logged data to USB memory, he should go to the required display (pressure logs for example), then press ENTER/SAVE key. To get out of this level and go back to main display, user shall press ESC key.

The saved data in USB will be stored in a file, which can be opened with Windows programs such as MS Word and Excel. It will be in the following formats:

PRESSURE LOG FORMAT

PRESSURE LOG			
DATE	**TIME**	**Pressure (PSI)**	**PUMP STATUS**
16/01/2011	13:22:09	300	ENGINE STOP
16/01/2011	16:21:30	350	ENGINE STOP
16/01/2011	16:21:45	340	ENGINE STOP
23/01/2011	17:13:01	320	ENGINE STOP
23/01/2011	17:13:23	290	ENGINE STOP
23/01/2011	17:13:38	270	ENGINE STOP
23/01/2011	17:13:53	275	ENGINE STOP
23/01/2011	17:14:08	273	ENGINE STOP
23/01/2011	17:14:23	273	ENGINE STOP
23/01/2011	17:14:38	279	ENGINE STOP
23/01/2011	17:14:53	150	ENGINE STOP
23/01/2011	17:15:08	90	ENGINE RUN
23/01/2011	17:15:23	80	ENGINE RUN
23/01/2011	17:15:38	85	ENGINE RUN
23/01/2011	17:15:53	80	ENGINE RUN
23/01/2011	17:16:08	83	ENGINE RUN

PRESSURE LOG FORMAT

EVENT / ALARM LOG			
DATE	**TIME**	**EVENT / ALARM**	**STATUS**
16/01/2011	16:21:16	System Booting	OCCURRED
16/01/2011	16:21:16	AC Power failure	OCCURRED
16/01/2011	16:21:16	Cranking Coil 1 failure	OCCURRED
16/01/2011	16:21:16	Cranking Coil 2 failure	OCCURRED
16/01/2011	16:21:16	Battery 1 failure	OCCURRED
16/01/2011	16:21:16	Low Pressure	OCCURRED
16/01/2011	16:21:51	System Booting	OCCURRED
16/01/2011	16:21:51	AC Power failure	OCCURRED
16/01/2011	16:21:52	Cranking Coil 1 failure	CLEARED
16/01/2011	16:21:52	Cranking Coil 2 failure	CLEARED
16/01/2011	16:21:52	Battery 1 failure	CLEARED
16/01/2011	16:21:52	Low Pressure	CLEARED
16/01/2011	16:21:56	System Booting	OCCURRED
16/01/2011	16:21:56	AC Power failure	OCCURRED
16/01/2011	16:21:56	Cranking Coil 1 failure	OCCURRED
16/01/2011	16:21:56	Cranking Coil 2 failure	OCCURRED
16/01/2011	16:21:56	Battery 1 failure	OCCURRED

Note: Logging rate will be selected from SETTINGS AND PARAMETERS (refer system configuration).

7.3. SYSTEM CONFIGURATION

User can enter this level by pressing ENTER key; system will ask user to enter password (default 0000).

If password is entered correctly then system will enter to three main levels: SETTINGS AND PARAMETER, EVENTS and AUXILIARY INPUTS (user can shift between theses three levels by UP/DOWN keys, then press ENTER to get into the selected one:

7.4. SETTINGS AND PARAMETERS

When user is in this level, he must press ENTER to go into sub levels. The following sub levels will appear and user can shift between them by pressing UP/DOWN keys (default values of system parameters can be seen between brackets [ ]), and user has to press ENTER again to go into the selected sub level to change the values of parameters. After changing parameters, user must press ENTER to save the new value. These sub levels are:

- ***LCD backlight mode***: This screen is to choose whether to keep LCD always on or to become off after 5 Min from last key pressed. User can see the choices and the default value on this display.

- ***DAY***: To Adjust Day

- ***DATE***: To Adjust Local Date

- ***TIME***: To Adjust Local Time

- ***Pressure Unit Selection:*** To select the unit of the pressure on display.

- ***Max Transducer Pressure:*** To enter the maximum rated pressure measured by the transducer.

- ***Pressure Trans volt:*** To enter the output voltage of the pressure Transducer. (Controller uses analog voltage output transducers; either 5 or 10 VDC).

- ***Engine Start pressure:*** To enter pressure value that causes engine to start automatically.

- ***Engine Stop pressure:*** To enter pressure value that causes engine to stop automatically (when pressure reach this point, pump will be no more on demand). User should avoid making start and stop pressure same – there should be enough pressure difference.

- ***Low pressure set time:*** To enter duration of low pressure, where after it system will consider that low pressure event has occurred and will take decision to start the pump (this to avoid effect of any transient fast drops in pressure).

- ***Low pressure reset time:*** To enter duration of high pressure, where after it system will consider that low pressure event has cleared. (This to avoid effect of any transient fast increase in pressure).

- ***Engine Start delay:*** This screen is to enter delay time in seconds before starting engine. This feature is mostly used with multi pumps starting.

- ***Cranking time:*** This screen is to adjust the cranking time of engine (also the rest time between two cranking).

- ***Pump in Single/Parallel:*** To select if pump is single/parallel or in series with other pumps.

- ***Deluge valve:*** To enable or disable effect of deluge valve.

- ***Automatic shutdown mode:*** To enable or disable automatic shut down mode.

- ***Stopper / fuel solenoid stop holding time:*** This screen is to enter the stopping holding time (holding time to keep stopper solenoid active and fuel solenoid inactive to make sure engine is stopped).

- ***Engine run holding time before auto stop:*** To enter the minimum duration of engine running after automatic start.

- ***Battery Alarm Voltage:*** To enter voltage value that causes battery alarm to start.

- ***Automatic test:*** To enable or disable weekly automatic test of engine.

- ***Auto test start delay:*** To enter time delay before starting automatic test (free contact will not be included in this delay if used, but only drainage solenoid valve activation will be delayed). This delay is mostly used to enable system to give remote alarm signal to guard room before starting, so as guard can attend testing.

- ***Automatic test day:*** To enter day of automatic test, so as the test will start once every week in this day.

- ***Automatic test time:*** To enter time of automatic test.

- ***Auto test run holding time:*** To enter the minimum duration of automatic test (minimum duration of activating of drainage solenoid valve).

- ***Time between pressure log samples:*** To enter time between recorded pressure readings.

- ***Change user password:*** To change user password.

- ***Reset Engine Run:*** To reset engine running hours counter to zero.

- ***Change to factory defaults:*** To change all setting back to factory default settings.

- ***Erase all system logs:*** To erase all recorded data of systems logs in the SD card.

7.5. EVENTS

This level is to program the additional events only (main events / alarms are already programmed and can't be changed). User can program three main actions for each event; audio alarm, LED indicator, and free contact. Some of these actions are not applicable with some events (Refer the event and alarm table "Table-3"). YH-D-M1 controller has 10 programmable extra indicator (LED), and 9 programmable extra output relays. These events are:

- **AC power healthy.**
- **Low Discharge Pressure.**
- **Deluge Valve On.**
- **Remote start On.**
- **Test On (LED is not programmable – fixed).**
- **Low Engine Temperature**
- **Low Raw Water Flow**
- **High Raw Water Temperature**
- **Engine Controller - Manual Mode**

Note: user can program certain LED or certain output relay with more than one event/alarm (to be as common LED / common relay).

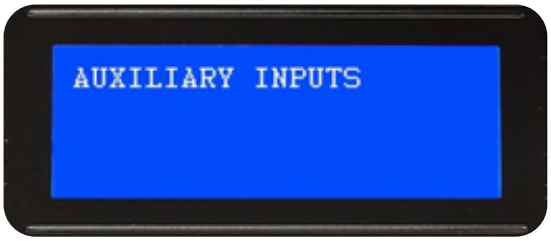
Example of programming one of these events (Low discharge pressure):

- ***Low discharge pressure audio:*** To enable/disable audio signal with this event.

- ***Low discharge pressure LED:*** To select LED number that will be activated with this event (o means no LED is selected).

- ***Low discharge pressure out relay [0], (0 – 8):*** To select output relay number that will be activated with this event (0 means no output relay is selected).

7.6. AUXILIARY INPUTS



This level is to program additional 11 auxiliary inputs. User can program three main actions for each auxiliary alarm; audio signal, indicator (LED) and free contact. System has 10 programmable extra indicator (LED), and 8 programmable extra output relays.

Example of programming one of these auxiliary inputs (Auxiliary input 1):

- Aux input_1 audio: To enable/disable audio signal with this input.

- Aux input_1 LED: To select LED number that will be activated with this input (0 means no LED is selected).

- Aux input_1 out relay: To select output relay number that will be activated with this input (0 means no output relay is selected).

8. YH-D-R1 HARDWARE

YH-D-R1 is a relay board designed to be connected with YH-D-M1 mother board. It contains of 20 output relay; 12 fixed alarms/events relays and 8 auxiliary programmable relays. The board has also 20 LED with the relays, to show the activated ones.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

NOTES

NOTES

Project Name	:.....
Location	:.....
Commissioned By	:.....
Date of Commissioning	:.....
Signature of Commissioning Engineer	:.....

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