NAFFCO
PASSION TO PROTECT

NFPA®

FM

UL®

NAFFCO UL LISTED ELECTRIC FIRE PUMP CONTROLLER

NFY-DOM1, NFY-SDM1 & NFY-SSM1

MICRO-PROCESSOR BASED

1. SANDARD FEATURES

- 380 / 415 or 220 / 240 VAC, 50 / 60 Hz main 3 phase system power.
- Voltage Surge Protector.
- Main disconnecting switch with rotary handle, sized for disconnecting motor horsepower and voltage.
- Circuit breaker with shunt trip coil and rotary handle.
- Rated motor contactors.
- Emergency run mechanism to mechanically close motor contactor contacts to start motor in case of emergency cases.
- Manual start and stop push buttons.
- 20x4 LCD display showing all system parameters and variables.
- Showing 3 phase line voltages.
- Showing 3 phase line motor currents.
- Showing real value of discharge pressure.
- Showing motor running hours.
- Showing ambient temperature.
- Power ON / Healthy indicator.
- Automatic mode indicator.
- Manual mode indicator.
- Motor Run indicator/free contact.
- Phase Loss / Failure alarm / indicator / free contact.
- Phase sequence error alarm / indicator / free contact.
- System error alarm / indicator / free contact.
- Fail to start alarm / indicator.
- System error alarm / indicator.
- Pump lockout indicator / free contact.
- Push button for alarm silence (only for additional alarms).
- Starting delay timer (programmable) for sequence multiple pumps starting.
- Automatic or manual shutdown after automatic start (selectable).
- Automatic shutdown mode enabled/disabled indicator.
- Motor locked rotor trip at 600% of FLA, after programmable time delay.
- Programmable automatic test, which can be programmed to start at any desired day in the week.
- Manual test push button.
- Motor overload alarm / indicator / free contact (programmable).
- Over voltage alarm / indicator / free contact (programmable).
- Under voltage alarm / indicator / free contact (programmable).
- Low discharge pressure alarm / indicator / free contact (programmable).
- Deluge valve on alarm / indicator / free contact (programmable).
- Remote start on alarm / indicator / free contact (programmable).
- Manual local start on alarm/ indicator / free contact (programmable).
- Fail while run alarm / indicator / free contact (programmable).
- Emergency start on alarm / indicator / free contact (programmable).
- Test on alarm/ indicator / free contact (programmable).

Fig. No. 01

- IO additional programmable indicators (LED's).
- IO additional programmable auxiliary digital inputs.
- 7 additional programmable output relays (free contacts).
- Pressure transducer with analog voltage output.
- Data logging system for pressure and events.
- USB port for saving recorded pressure and evens on USB memory

2. Sequence of Operation

This controller is working under both automatic and manual modes with manual or automatic shutdown (automatic shutdown is possible only after automatic start).

2.1. Manual Mode

- In this mode, there will be no effect of pressure sensor and deluge valve.
- Manual start of motor can be done by pressing start P.B.
- Manual start can also be done by pushing a mechanical handle labeled "Emergency Start". This handle provides direct on line continuous starting
- In this mode motor can be stopped only manually by pressing Stop P.B.
- All alarm signals are operational in this mode.

2.2. Automatic Mode

- In this mode, if pressure goes down till the cut-in pressure point then motor will start automatically after adjustable delay (programmable).
- 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 motor to prevent simultaneous starting of all motors. Sequential starting can be adjusted by a programmable timer (1 – 99 seconds). User has to specify if 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 delay starting in automatic mode only, but starting in manual mode will not be delayed. In the second case (series), system will delay starting in automatic mode and in manual mode, and this is to avoid dry running of pump (see table1):

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
Manual Start	No Delay	With Delay

• If remote start switch was momentary actuated, motor 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 deluge valve signal and low pressure signal.

• Motor 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).

• Two ways of shutdown are possible in this mode (operator have to select one of them by software):

1. Manual shutdown: After automatic start, motor can be stopped in this mode only by pressing manual stop push button. If the pump was on demand (low pressure or deluge valve active), and in auto mode, then pump cannot be stop manually, unless it is not on demand any more.
2. Automatic shutdown: After automatic start, controller will keep motor running for a period varies from 1 to 120 minutes (programmable). After that, if the pump was not any more on demand, then controller will automatically shut down the motor. 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

• 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 automatic 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.

3. FUNCTIONALITY

- During operation of the system, controller will be reading voltages, currents, pressure, and sensing many input signals. These reading can be monitored on the LCD display.

- If controller detected loss of one phase or more, then it will give an alarm and will prevent the motor from starting, but if the loss of phase happened while the motor was running, then controller will give alarm but will not stop the motor.

- If controller detected phase reversal, it will give alarm and will not start the motor.

- Controller will detect over voltage, under voltage and overload (over current), and will give alarms showing these errors.

- If the controller closed contactors to start the motor (due auto or manual start), but the motor didn't start after some delay (programmable time delay), then controller will give alarm (fail to start alarm). Controller will sense if motor started or not by sensing the motor current.

- If the controller closed contactors to start the motor (due auto or manual start), but the motor didn't start after some delay (programmable time delay), because of LOCKE ROTOR, then controller will activate the shunt trip coil of the MCCB and shut it down. Controller will sense if motor is in locked rotor situation or not by sensing the motor current

4. Electronic Controller YH-E-M1:

Fig. No. 02

5. YH-E-M1 Hardware

• YH-E-M1 is an electronic mother board designed to be installed in NFY-SDM1 control panel. It is programmed to handle certain functions to control a motor connected with a fire pump. This motor fire pump's duty is to maintain high pressure in the discharge pipe, so as all water network will be pressurized (pressure value is programmable), See Fig 3:

• YH-E-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 program the system; see Fig 2.

• Has 16 digital inputs; 6 inputs are necessary for the basic functions of controllers, the remaining 10 are auxiliary and programmable.

• Sensing 7 analog signals; 3 phase AC line voltages, 3 phase AC line 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.

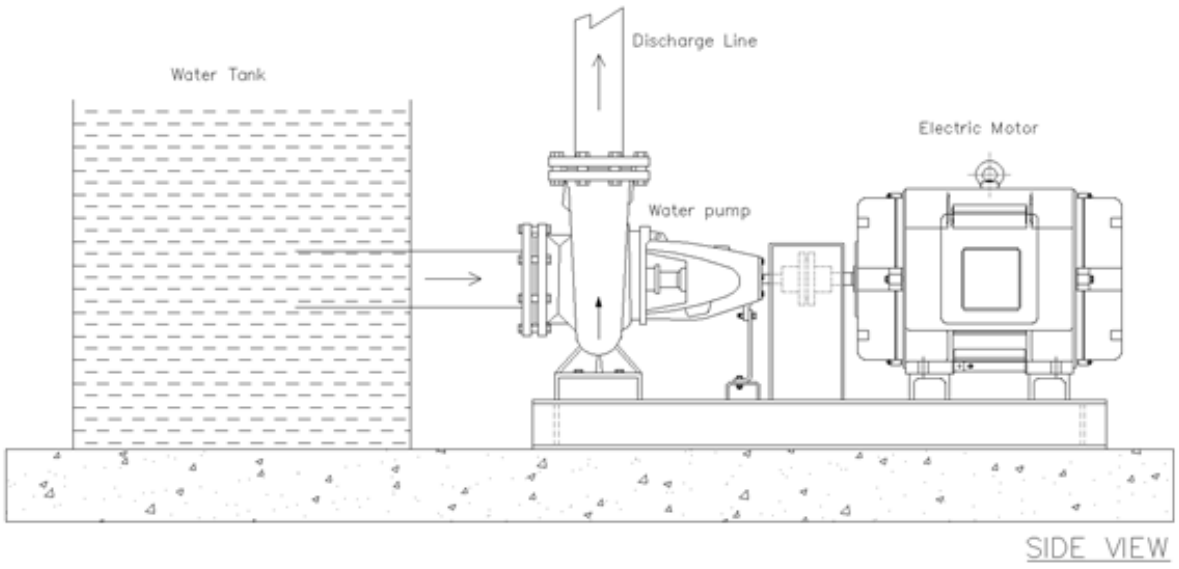


Fig. No. 03

6. YH-D-M1 Software Structure

YH-E-M1 controller is programmed to control the motor operation according to NFPA20 standard. This controller has 8 keys (push buttons) to enable user to go through the software and adjust the user values 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).

7. Event and Alarms

YH-E-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	AC Power On	No	Yes	Yes (Fail Safe)
	Phase Loss / Failure	Yes	Yes	Yes
	Phase Reversal	Yes	Yes	Yes
	Motor Run	No	Yes	Yes
	Auto Mode	No	Yes	No
	Manual Mode	No	Yes	No
	Auto Shutdown Mode	No	Yes	No
	Pump Lockout	No	Yes	Yes
	Failed to Start	Yes	Yes	Yes
	Test On	Programmable	Yes	Programmable
	Auto Test Mode	No	Yes	No
	System Error	Yes	Yes	Yes

Additional	Motor Overload	No	Yes	Yes
	Over Voltage	Programmable	Programmable	Programmable
	Under Voltage	Programmable	Programmable	Programmable
	Low Discharge Pressure	Programmable	Programmable	Programmable
	Deluge Valve On	Programmable	Programmable	Programmable
	Remote Start	Programmable	Programmable	Programmable
	Manual Local Start	Programmable	Programmable	Programmable
	Emergency Start	Programmable	Programmable	Programmable
	Fail While Run	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

- Power On/ healthy: Will be on when the AC power is normal and connected.
- Phase loss/Failure: This event will be activated when one or more of the 3 phase lines are lost.
- Phase sequence error: Will be activated when the 2 phase lines sequence is not correct (sequence should be L1, L2 and L3).
- Motor Run: Will be activated when motor starts running (system will detect motor's running by sensing it's current).
- Automatic mode on: Active when system is on auto mode.
- Manual mode on: Active when system is on manual mode.
- Automatic shutdown mode: Active when automatic shutdown is activated (enabled).
- Pump Lockout: Active when lockout switch is activated.
- Fail to Start: Will be activated when the controller tries to start the motor but the motor does not run. (System will detect motor's running by sensing it's current).
- 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. This error will cause pump to start immediately (Emergency Start). If memory card is removed or not installed, SYSTEM ERROR alarm will be activated but will not start the pump.
- Motor Overload: Active when current consumed by the motor (3 lines currents) are more than rated current of motor.
- Over Voltage: Active when three phase voltages are more than rated voltages.
- Under Voltage: Active when three phase voltages are less than rated voltage.
- Low discharge pressure: Active when water pressure (measured by pressure transducer) goes below the starting pressure (cut in pressure).

- Deluge Valve on: Active when deluge valve contact is activated (opened).
- Remote start on: Active when remote start push button is pressed.
- Automatic test Mode: Active when the automatic weekly test is enabled.
- Test On: Active when test (automatic or manual) is on (Running).
- Manual Start: Active when motor is started manually and locally by Start P.B.
- Emergency start: Active when motor is started manually by the mechanical emergency handle, or by SYSTEM ERROR alarm.
- Fail While Run: Will be activated when motor stops during running. (System will detect motor's running by sensing it's current).

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

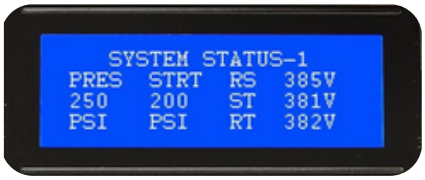
8. Program displays and settings

8.1. Main display

Main display:
In normal conditions, LCD shows 3 main displays:

- Pressure / 3 phase voltages display.
- 3 phase currents display.
- Time /date / ambient temperature / motor running hours display.

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



Note: For resetting motor running hours, user has to go to TIME / DATE RUNNING HOURS display, and then press ESC/REST key for 10 seconds.

8.2. 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 (events in table 3) 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:

8.3. Pressure Logs Format

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

8.4. Event / Alarm Logs format

Event / Alarm Log	VER 1.0		
DATE	TIME	PRESSURE (PSI)	PUMP STATUS
16/01/2011	16:21:16	Manual Mode On	OCCURRED
16/01/2011	16:21:16	Manual Local Start	OCCURRED
16/01/2011	16:21:16	Motor Run	OCCURRED
16/01/2011	16:21:16	Motor Over Load	OCCURRED
16/01/2011	16:21:16	Automatic Mode On	OCCURRED
16/01/2011	16:21:51	Motor Over Load	CLEARED
16/01/2011	16:21:51	Motor Run	CLEARED
16/01/2011	16:21:52	Manual Mode On	OCCURRED

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

8.5. 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:

8.6. Settings and Parameters

When user is in this level, he must press ENTER to go into the sub levels. The following sub levels will appear and user can shift between them by pressing up and down keys (default values can be seen between brackets [ ]), and user has to press ENTER again to go into the selected sub level to change the values and parameters. After changing parameters, user must press ENTER to save the new parameter, then press ESC to get out the sub level and go to another. These sub levels are:

- LCD backlight mode (0 Always on / 1 Save mode) [0]: This screen is to choose whether to keep LCD always on or to become off after 5 minutes 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

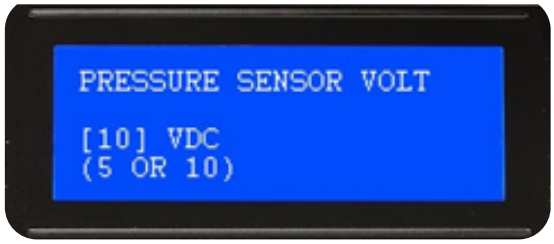
- Motor Full Load AMPS: To enter rated current of motor.

- Rated voltage – Line to Line: To enter the rated line to line voltage of the 3 phase system.

- Current Transformer Ratio: To enter the ratio of the current transformers which are used to measure line currents (the entered value is for primary windings of current transformers, and secondary windings value is fixed and always 5 A).

- 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).



- Motor Start pressure: To enter pressure value that causes motor to start automatically.

- Motor Stop pressure: To enter pressure value that causes motor 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).

- Motor Start delay: This screen is to enter delay time in seconds before starting motor. This feature is mostly used in multi pumps starting.

- Motor Star-Delta timer: This screen is to enter time delay to transfer the motor running method from star to delta.

- Pump in single/parallel or series: This screen is to specify if the pump is connected in single, parallel or series connection.

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

- Automatic shutdown mode [Enabled]: To enable or disable automatic shutdown mode.

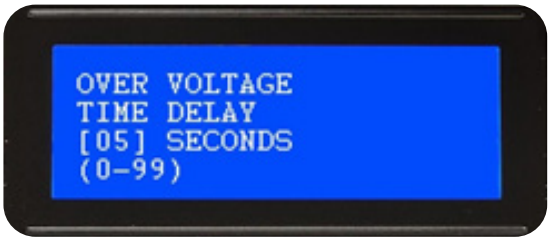
- Motor run holding time before auto stop: To enter the minimum duration of motor running after automatic start.

- Over load alarm percent: To enter the percentage of current according to FLA, where over load alarm will be activated if current is equal or more than this value.

- Over load alarm time delay: To enter time delay before this alarm is activated.

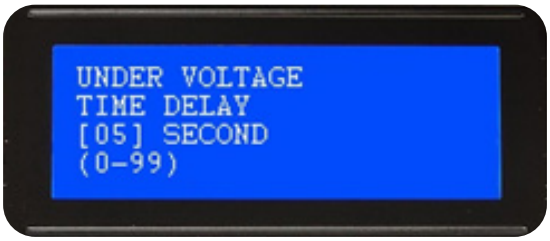
- Over voltage alarm percent: To enter the percentage of voltage according to rated voltage, where over voltage alarm will be activated if voltage is equal or more than this value.

- Over voltage alarm time delay: To enter time delay before this alarm is activated.



- Under voltage alarm percent: To enter the percentage of voltage according to rated voltage, where over voltage alarm will be activated if voltage is equal or less than this value.

- Under voltage alarm time delay: To enter time delay before this alarm is activated.



- Phase loss alarm percent: To enter the percentage of voltage according to rated voltage, where phase loss alarm will be activated if voltage is equal or less than this value.

- Phase loss alarm time delay: To enter time delay before this alarm is activated.

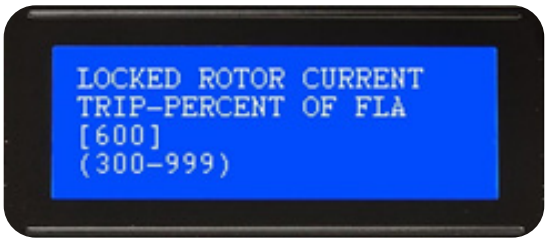
- Phase reversal alarm time delay: To enter time delay before this alarm is activated.

- No load percentage of FLA: To enter the percentage of current according to FLA, where fail to start alarm will be activated if current is equal or less than this value.

- Fail to start alarm time delay: To enter time delay before this alarm is activated.

- Fail while run alarm time delay: To enter time delay before this alarm is activated.

- Locked rotor current trip – percent of FLA: To enter the percentage of current according to FLA, where locked rotor current trip will be activated if current is equal or more than this value. When activated, controller will give signal to the shunt trip coil of the MCCB to shut it down and cut power of the whole system.



- Locked rotor current trip time delay: To enter time delay before this trip is activated.

- Automatic test [Enabled]: To enable or disable weekly automatic test of motor.

- 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 activation 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.

8.7. EVENTS

This level is to program the additional events only (main events/alarms are already programmed and can't be changed) see table 3. User can program three main actions for each event; audio signal, indicator (LED), and free contact. Some of these actions are not applicable with some events (see table 3). System has 10 programmable extra indicator (LED), and 8 programmable extra output relays. These events are:

- Motor Over load.
- Over Voltage.
- Under Voltage.
- Low Discharge Pressure.
- Deluge Valve On.
- Remote start On.
- Manual Local Start.
- Emergency Start.
- Fail While Run.

(For more details see eventand alarm table)

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).

8.8. 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).

9. YH-E-R1 HARDWARE

YH-E-R1 is a relay board designed to be connected with YH-E-M1. It contains of 20 output relay; 13 fixed alarms/events relays and 7 auxiliary programmable relays. The board has also 20 LED with the relays, to show the activated ones.

Com password **2504**

* * * * * * * * * * * * * * * * * *

NOTES

NOTES

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

NAFFCO
PASSION TO PROTECT

NAFFCO
Email: info@naffco.com
www.naffco.com

NFY-EC-IOM/2019/V.01

FOR ANY ASSISTANCE, PLEASE CONTACT
800-NAFFCO
8 0 0 6 2 3 3 2 6
customerservice@naffco.com