

Diesel Engine Performance Analyzer

MIP3000-2S

User's Manual



MEIYO ELECTRIC CO., LTD

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1 MIP3000

1.1 Overview

- MIP3000 is a portable system which measures and analyzes status of combustion of a main diesel engine.
- A high pressure combustion sensor is fitted onto the cylinder head of a 2-cycle diesel engine of maximum 300 RPM to measure data while the engine is in operation and the measured data is analyzed on site.
- The MIP3000 also can be interfaced with personal computer for further analysis using a variety of Windows programs.
- The MIP3000 is an “Off-Line System “, not an “On-Line System “.

1.2 Purpose

- MIP3000 provides the user with information about the combustion of each cylinder to operate the engine in optimum condition.
- Economical fuel consumption can be achieved by the analysis of information provided.
- With the information provided the users can find out the status of parts which enables the user to perform preventive maintenance in an efficient manner.

1.3 Features

- Comparison and analysis of Pmax, Pcomp, Diff, RPM, MIP, load, power comparison for each & all cylinder with trend.
- Highest vs. lowest compression pressure of inside cylinder, compression pressure vs. maximum pressure.
- Calculation of Mean Indicated Pressure and Indicated Horse Power.

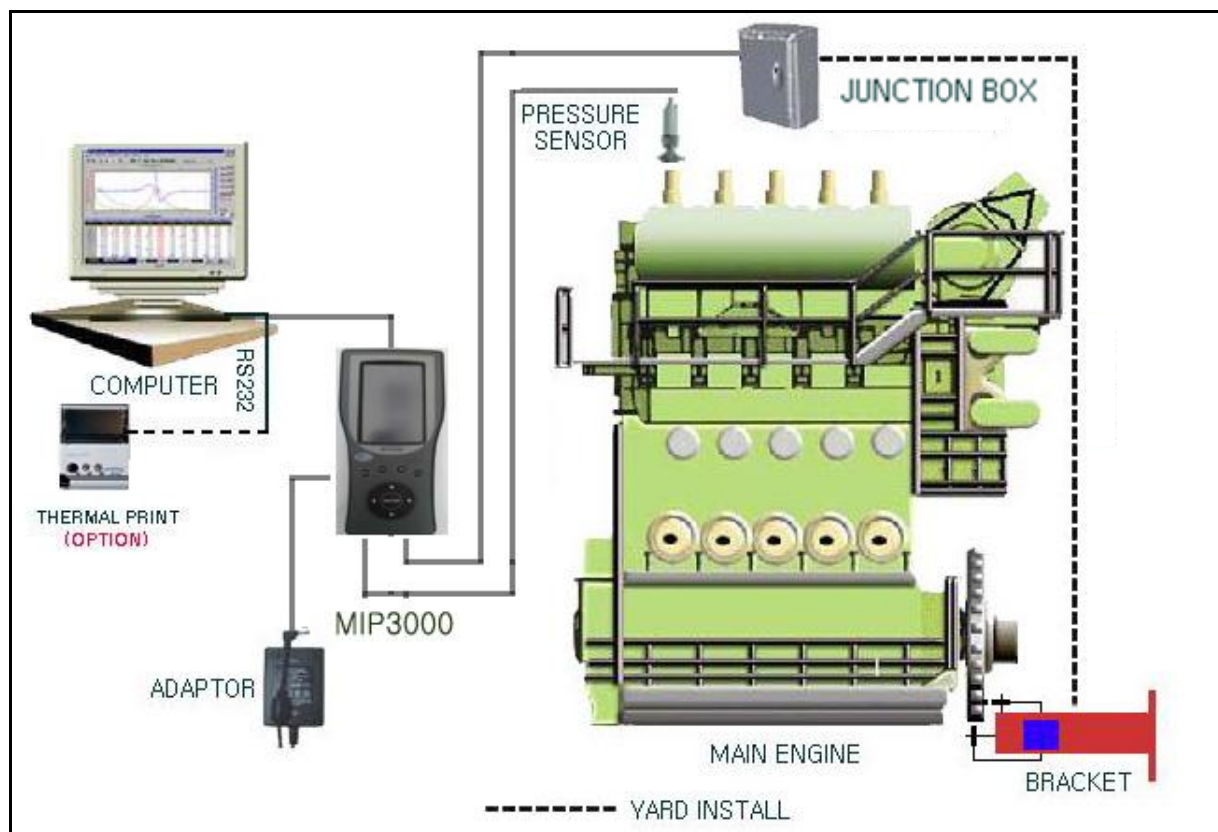
1.4 Supply Scope

1. MIP3000	1 set	2. Combustion Sensor	1 set
3. Program CD	1 pc	4. Sensor Tool	1 pc
5. Battery Charger	1 pc	6. RS232C Serial Cable	1 pc
7. Connector Cable	1 set	8. Bracket	1 set
9. Proximity Sensor	2 set	10 Sensor Box	1 set
11. Junction Box	1 set	12. Connection Cable	40 M
13. Sensor Cable with Plug	1 set		

2 System Configuration and Specification

The system consists of an MIP3000 and sensor(s) & display unit (Printer (option) or PC).

2.1 System Configuration



< Fig. 2-1 >

**** Remark: Personal Computer is not supply scope by Maker.**

2.2 MIP3000 Specification

- Case : black high impact ABS
- Display : 58 x 98 mm color touch screen
- Keypad : 9 keys
- System : 32 bit Micro Processor , 10 bit A/D converter,
32 M x 8 bit NAND Flash Memory, SD Memory card 1 GB
- Input Port : Combustion, TDC, Teeth Angle
- Serial Communication : RS232C
- Operating Temperature : 0~50 °C
- Dimension : 230 × 100 × 30 mm
- Weight : 800 g

2.3 MIP3000 POWER SPECIFICATION

- Case : black high impact ABS
- Power : 4.2 V rechargeable Lithium-Polymer battery, 2900 mAh
- Using Battery Power on system : 3.2 V
- Battery Operating Time : 10 hours
- Battery Full Charge Time : 3.5 hours
- Battery Charger : AC100~240V 50/60Hz input / DC5V/2A output

2.4 Measure/Analysis Specification

- RPM Range of Main Engine : 50 ~ 300RPM
- Sampling Interval : 0.1 Degrees
- Max. Cylinder Number : 22 Cylinders

2.5 MIP3000 Keypad



< Fig. 2-2 >

- ① MENU Key: used to show Main Icons on screen for select functions.
- ② TEST Key: used to operate TEST Mode for show TDC, TEETH SIGNAL and calculate Teeth Quantity, RPM & Combustion Pressure with graph.
- ③ UP/DOWN ARROW Keys : used to move cursor to UP/DOWN side or go to previous/next entry field
- ④ LEFT / RIGHT ARROW Keys: used to move cursor to LEFT / RIGHT side or change digits on entry field.
- ⑤ ESC Key: used for return to the previous screen.
- ⑥ ENTER Key: used to execute the selected menu.
- ⑦ BAT Lamp: when charging Battery with battery charger, light on the lamp by green and will light off when fully charged.
- ⑧ PWR Lamp: when power switch shift to ON position, PWR Lamp will light on by red with screen for show preparation condition with Main Menu.
- ⑨ M/E Key : used to M/E Acquisition for acquire Engine Data

2.6 Sensors

2.6.1 Combustion Sensor

Strain Gauge Combustion Pressure Sensor	: measures inner cylinder pressure
Range	: 0 ~ 250bar
Sensitivity	: 4~20mA
Natural Frequency	: 60 kHz
Operating Temperature Range	: -40 ~ 125 °C
Cable Length	: 1.5m

2.6.2 TDC & Teeth Sensor

TDC Pickup and Teeth Sensor	: measure RPM and angle
Input	: 12 ~ 48VDC
Frequency	: 2 KHz
Operating Distance	: 0 ~ 6.4 mm
Temperature Range	: -25~125 °C
Protection	: IP68

2.7 Main Menu

When the MIP3000 is turned on, the user can quickly check the model and REL/VER information screen together with the main menu screen < Fig. 2-3 >

To open a menu, simply touch an icon.



< Fig. 2-3>

- **ENGINE DESCRIPTION**

Touch “ENGINE DESCRIPTION” Icon for enter an engine initial data according to Engine Specification.

- **FIRING ORDER**

Touch “FIRING ORDER” Icon for enter Engine firing order and divided Crank Angle according to Engine Specification & Cylinder Quantity.

- **ACQUISITION**

Touch “ACQUISITION” Icon for acquire Engine Performance Data through Combustion Sensor from Engine.

- **ANALYSIS**

Touch “ANALYSIS” Icon for plot the acquired Engine Performance Data in various graphs or tables for easy comparison and analysis.

- **DATA COMMUNICATION**

Select “PC UPLOAD” Icon for transfer the acquired Engine Performance Data to a PC.

- **TEST MODE**

Touch “TEST MODE” Icon for used to diagnose & confirm Combustion Pressure, TDC & Teeth Sensor signal.


2.8 Quick Operating Manual

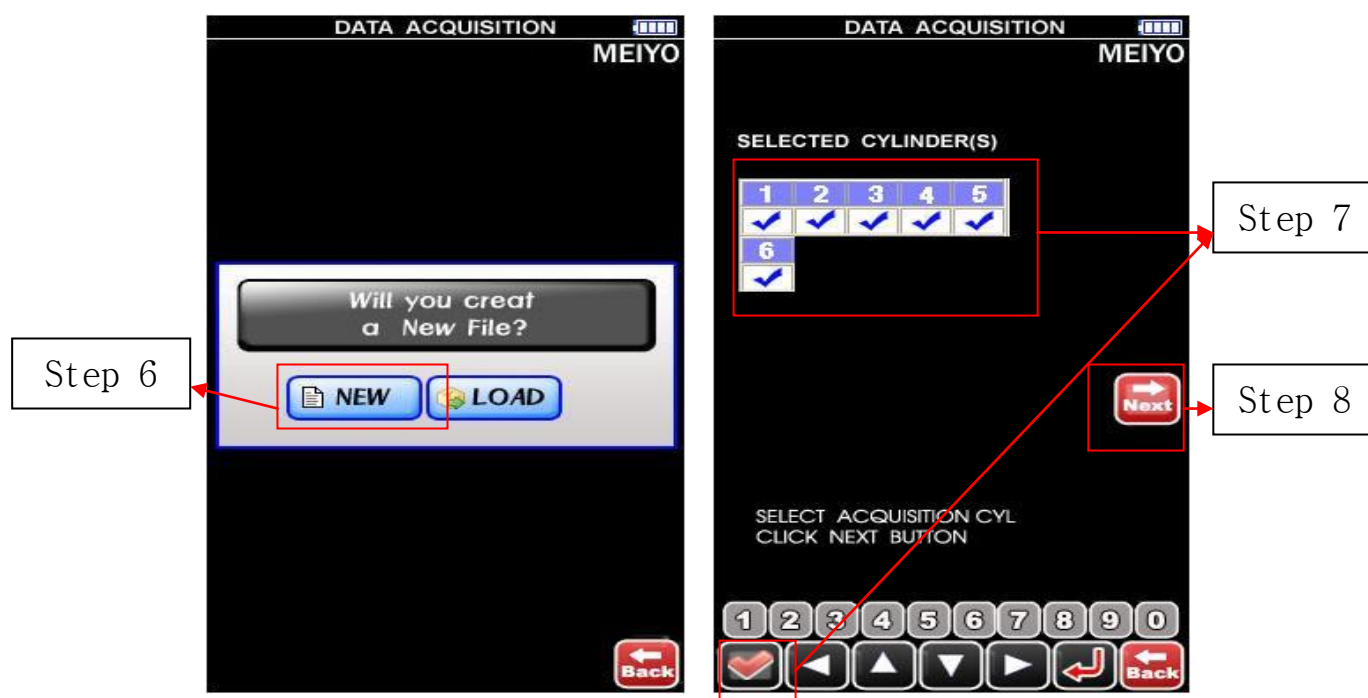
**** Important:** Before acquisition Engine Performance Data with MIP3000, must be refrigerate Combustion Sensor when User want to take Engine Performance Data with MIP3000 repeatedly.

2.8.1 "NEW "Measurement

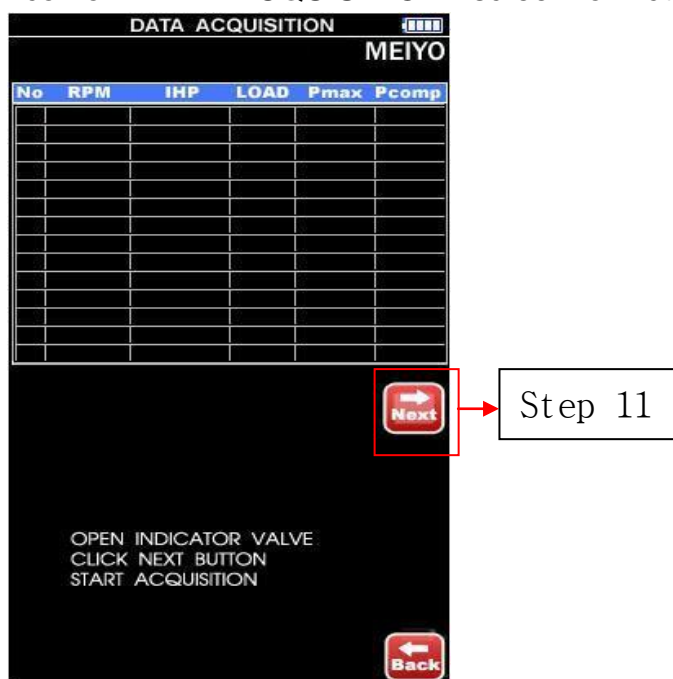
1. Power on the unit by the ON/OFF switch.
2. Connect TDC/TEETH signal connector to MIP3000.
3. Connect Combustion Sensor connector to MIP3000.
4. Touch "ACQUISITION " Icon on Main Menu.
5. Select Engine Load which wants to take data at present or select similar Engine Load which knew by User side.



6. Select "NEW " Icon.
7. Select all cylinders by touch or touch  at lower left corner.
8. Touch "NEXT " Icon to display "DATA ACQUISITION " screen.
9. Install Combustion Sensor to No. 1 Cylinder Indicator Cock.
10. Open Indicator Cock.

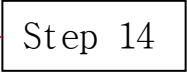


11. Touch "NEXT " Icon on "DATA ACQUISITION " screen for Acquisition.



12. Check sampling data procedure by Cycle No., RPM & Teeth Count.

13. After confirm message "CLOSE INDICATOR VALVE " on screen, close indicator cock & Acquisition for one Cylinder is complete.

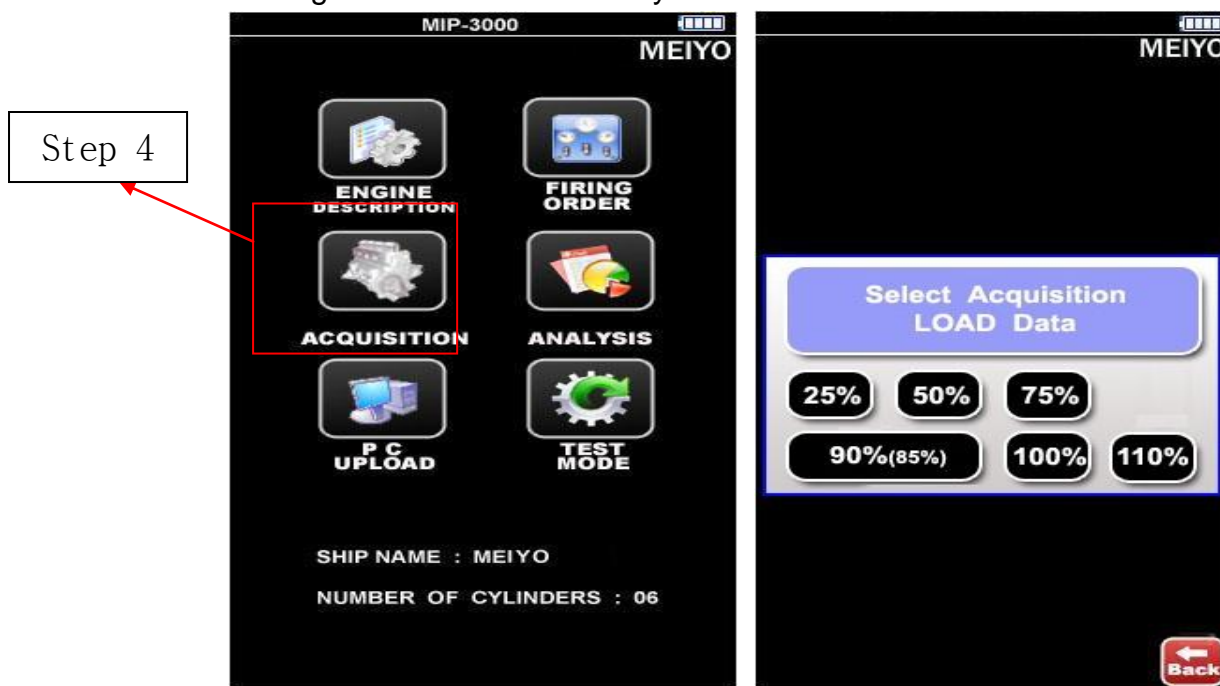


17. Select "SAVE " Icon to save data to SD Ram.

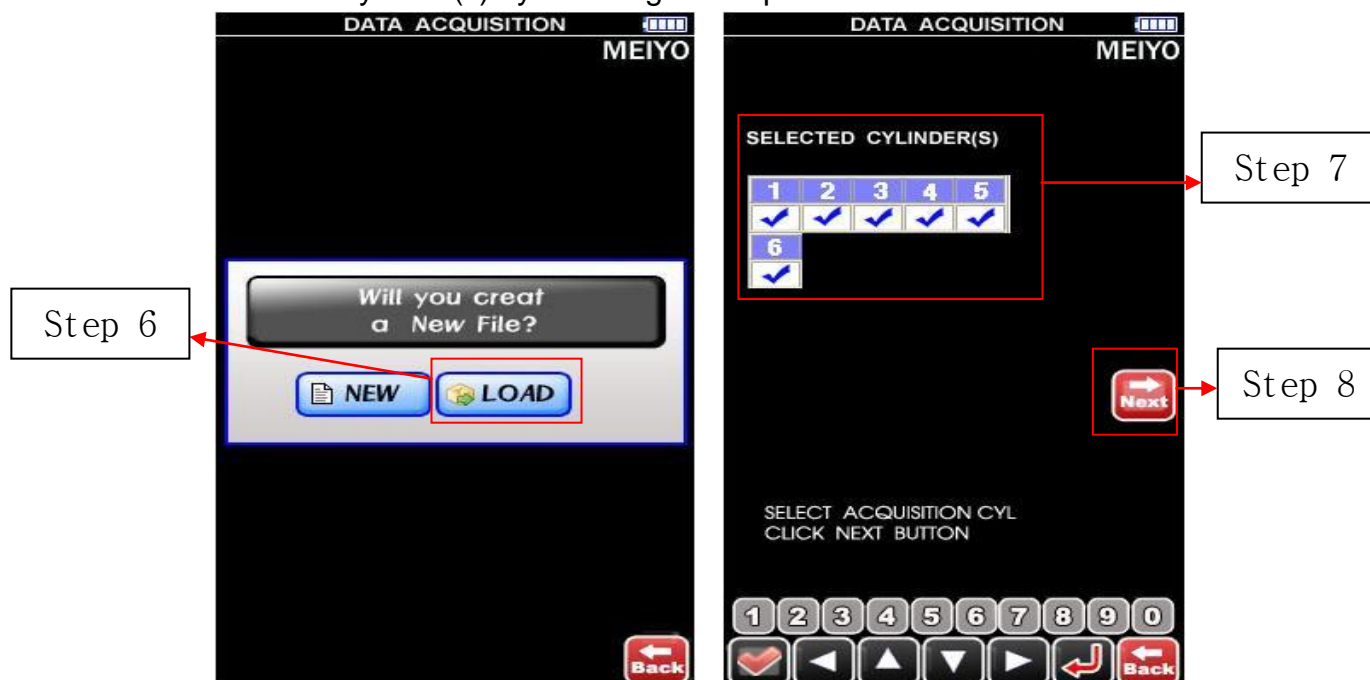


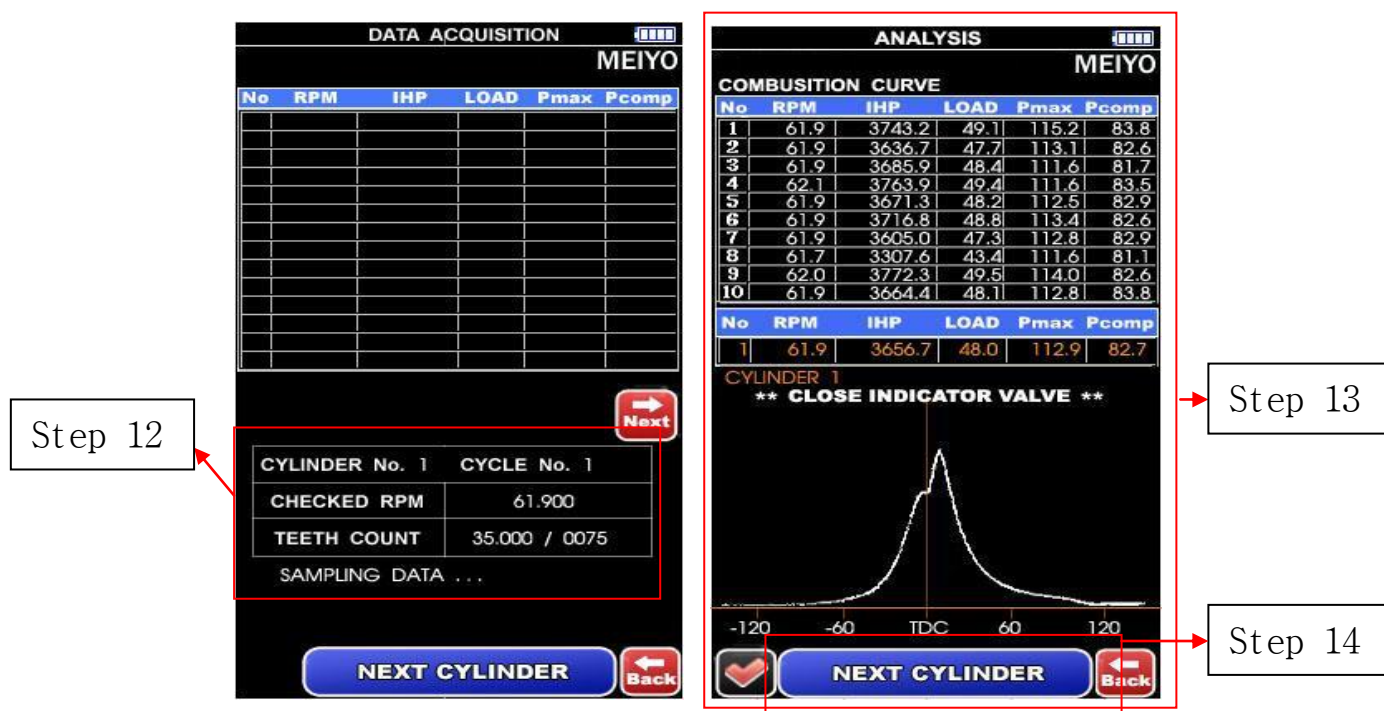
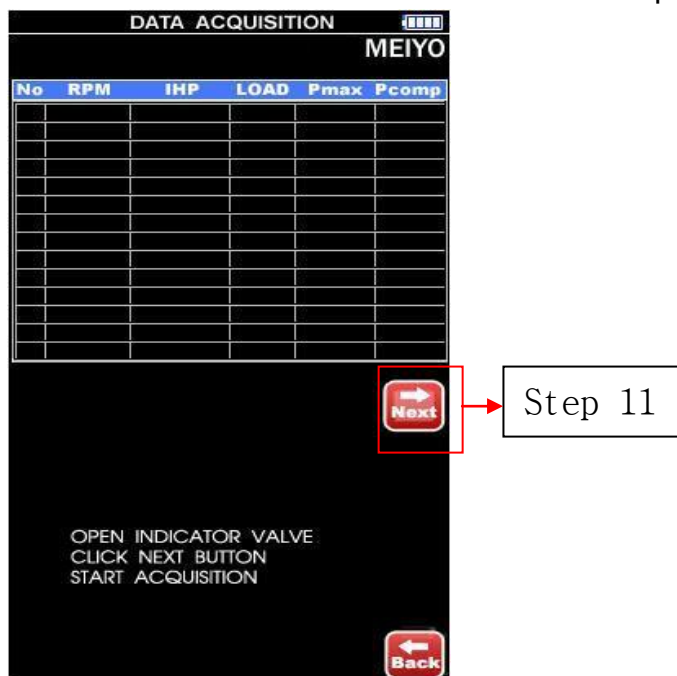
2.8.2 "LOAD " Measurement

1. Power on the unit by the ON/OFF switch.
2. Connect TDC/TEETH signal connector to MIP3000.
3. Connect Combustion Sensor connector to MIP3000.
4. Touch "ACQUISITION " Icon on Main Menu.
5. Select Engine Load which wants to take data at present or select similar Engine Load which knew by User side.

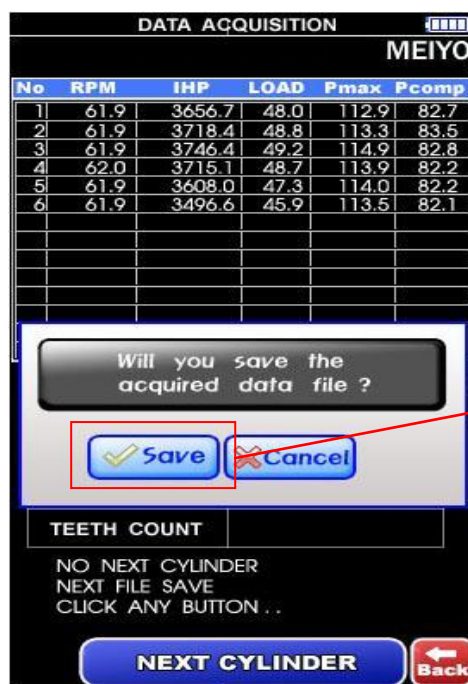


6. Select "LOAD " Icon.
7. Select cylinder(s) by touching for acquisition.





14. Touch "NEXT CYLINDER" Icon to return to "DATA ACQUISITION" screen (Step 7).
15. Repeat Step 8 to 13 for other Cylinder(s).
16. After completing acquisition, touch "NEXT CYLINDER" Icon (Step 13).
17. Select "SAVE" Icon for save data to SD Ram.



Step 17

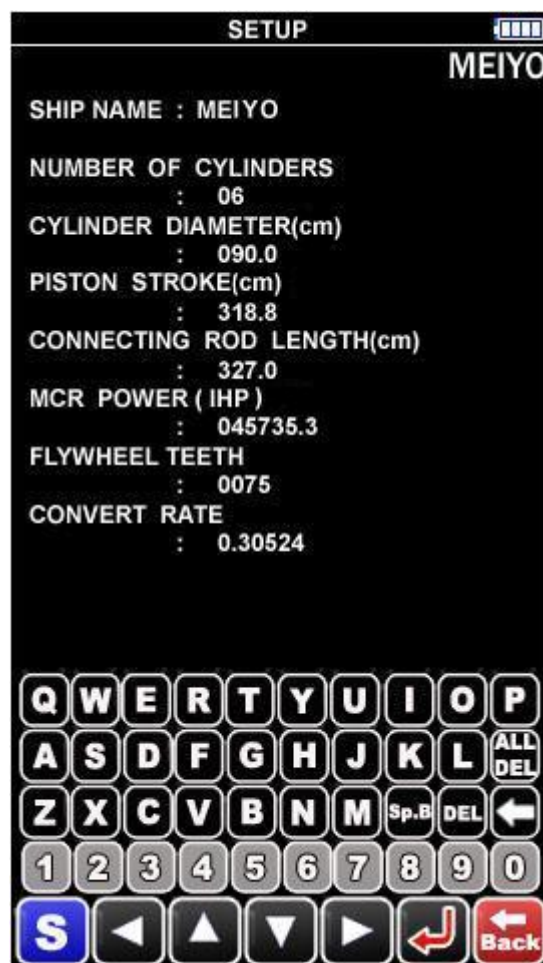
3 Operating MIP3000

3.1 Setting Up Initial Engine Data





To operate the MIP3000 for the first time, the initial data of the Engine should be set up. The set up data must be entered for the system to operate correctly.





Usually the set up data is done once at the beginning, and can be modified later if user needs.

< Setting Up Engine Data>



< Fig. 3-1 >

1. Touch "Engine Description" Icon on the main menu for set up Initial Data < Fig. 3-1 >.
2. The cursor will appear in the "SHIP NAME" field.
3. Enter the ship name by touch Alphabets on the below of screen. Touch ENTER  to save the entries or down button  on the below screen and then cursor will move to next field "NUMBER OF CYLINDERS".
4. Touch a numeric buttons on the below screen for enter the number, and touch ENTER  to save entry or down button  on the below screen for move to next field.

5. Touch a numeric key on the below screen for enter the cylinder diameter in the "CYLINDER DIAMETER (cm)" field. And touch ENTER  to save entry or down button  on the below screen for move to next field.
6. Input the values of "PISTON STROKE", "CONNECTING ROD LENGTH", "MCR POWER", and "FLYWHEEL TEETH" fields in the same manner.
 - **(MCR POWER means IHP (Indicated Horse Power) and can calculate as $\text{KW}/0.7355 = \text{BHP}$, $\text{BHP}/0.94(\text{Mechanical Efficiency}) = \text{IHP}$)**
 - ** Note: Engine specification should be confirmed by user before use the MIP3000. If user does not know "CONNECTING ROD LENGTH" , please check Engine Instruction or ask the Engine Maker or Meiyo Electric Co., Ltd. (H.P.:www.meiyoelc.co.jp, Mail:sal-shimizu@meiyoelc.co.jp)
 - **Note: When MCR is input to SETUP, please input MCR power as below: (Ex. If MCR is 21550 IHP, then input 021550.0 on the SETUP screens – it should be kept 8 digits).
7. "CONVERT RATE" in the Convert Rate Field is set by the manufacturer, and should not be changed without manufacturer's order.
8. When the last field is filled in and touch SAVE button  on the below screen for save all data and entry information will change color by confirmation of entry change. Touch BACK button  on the below screen for escape Setup Menu.

< Setting Up a Firing Order >

FIRING ORDER MEIYO

FIRING ORDER







1 → 5 → 3 → 4 → 2 →
6

CRANK ANGLE

180.0	240.0	300.0	000.0	060.0
120.0				

1 2 3 4 5 6 7 8 9 0
S ← ↑ ↓ → ↩ Back

< Fig. 3-2 >

1. Press the “FIRING ORDER” icon on the main menu to enter (confirm) the firing order and crank angle. < Fig. 3-2>
2. The cursor will move to the No.1 cylinder position. Enter the firing order sequentially.
3. If the sequence is 1,4,6,2,7,3,5, press 1 and the down button  or the ENTER button , touch 4 and the down button  or the ENTER button  and so on.
If the number of cylinders is more than 10, they should be input as two digits. (For example: 01-04-06-10-07-03)
4. When the firing order is finished being entered, the cursor will move to the first box of the “CRANK ANGLE”.
5. For the “CRANK ANGLE”, input the calculated values.
 For example: (For 12 cylinders → $360^{\circ}/12$ (Cylinder Quantity) = 30° (Interval of Firing Angle of Each Cyl.), Input Angle to the MIP3000 should be: 180° - 210° - 240° )
**** Note: In case of uneven Firing Angle, user can input Angles directly.**
6. After crank angle data is entered blank as in < Fig. 3-2>, press the SAVE button  at the bottom of the screen to save all data and information entered. Confirmation of the saved data is indicated by a color change to green.
7. Press the BACK button  at the bottom of the screen to escape the “FIRING ORDER” Menu.

3.1.3 Setting Up a Scavenging Air Pressure

For the input Scavenging air pressure to system, refer Engine Maker Test Report or Sea Trial Report and carry out below procedure.



< Fig. 3-1-3 >



< Fig. 3-1-4 >



< Fig. 3-1-5 >



< Fig. 3-1-6 >

1. Turned on Main Power and MIP3000 display Main Menu screen as <Fig 3-1-4.>.
2. For display scavenging air input screen, touch “Enter” key at <Fig. 3-1-3>.
3. Input Scavenging Air Pressure to system with below numeric key & arrow key with Engine Report data as a <Fig. 3-1-5). .
4. After complete input Scavenging Air Pressure, touch  for save data to system.
5. For remove Scavenging air input screen on Main Menu, touch  & “Enter” key at <Fig. 3.3> in order.
6. For confirmation of data input, carry step 2 for open input screen for check input data & step 5 for close input screen as a <Fig. 3-1-6>.

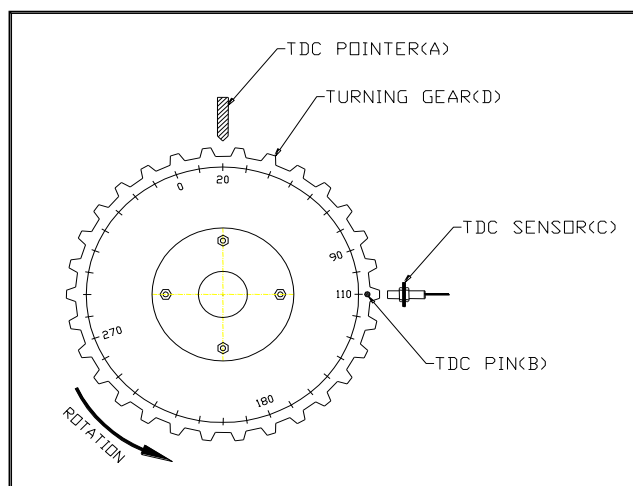
3.2 Notes

- Acquired MIP data and the all stored data will keep in a SD memory card even if the power turned off.
- Anyway, any acquired important data must be stored in a PC according to your decision.
- When you want to measure again for remaining cylinder if stopped measuring due to power turned off or missing signals of combustion sensor or TDC & Teeth Sensors, touch the LOAD button for call previous data.
- Then, last memorized data on a SD memory card will appear on a screen.
- If “M/E ACQUISITION” are executed for took Engine Performance Data, all data will save on SD memory card and can calling out to screen anytime.
- MIP3000 uses a 32 bit Micro Processor , 10 bit A/D converter, 32 M x 8 bit NAND Flash Memory, SD memory card 1GB
- When saved data in SD memory card are big, you can transfer them to PC through Card Reader or download.
- If the sampling is done over two times for the same cylinder by using Program “LOAD”, lastly acquired data will be shown.
- First of all, save the acquired data or select NEW Icon for avoid overlapping of same cylinder.
- For safety, disconnected Battery Charger of MIP3000, when the battery is being fully charged.
- Full discharging of the battery is not helpful for extend the battery life.
- There is Main power switch on upper side of MIP3000. < Fig. 3-3 > and if the Main power switch turned on, the LCD monitor & PWR lamp light on.



- ① SD Memory Card
- ② Battery Charger Connector
- ③ RS232 Communication Port
- ④ Power Switch

3.3 Each cylinder TDC adjustment method



< Fig. 3-4 >

**** If not installed Encoder on Engine, carried out below adjustment method.**

1. Turn the flywheel using turning gear and stop at the No. 1 TDC point
2. Install TDC Pin on flywheel with TDC Sensor & Teeth Sensor with bracket. Then, basic angle is 180° & add shared angle value to next Cyl. ($360^\circ / \text{Cyl. No.} = 60^\circ$)

**** If you cannot turn flywheel to No. 1 TDC point. Please calculate angle as bellows.**

3. Turn the flywheel in the forward direction using turning gear and stop at the point which is located TDC PIN (B) with TDC SENSOR (C) already installed to bracket.
4. Read the angle at the TDC POINTER (A).
5. TDC angle calculation
 - ① If an angle of TDC POINTER (A) is belonged in ($0^\circ \leq \text{the TDC POINTER (A) angle} < 180^\circ$), is calculated as follows.
 No.1 cylinder angle: $180^\circ - \text{The angle of the TDC Pointer (a)}$
 - ② If the angle of TDC POINTER (A) is belonged in ($180^\circ \leq \text{the TDC POINTER (A) angle} < 360^\circ$), is calculated as follows.
 No.1 cylinder angle : $(360^\circ - \text{The angle of TDC Pointer(a)}) + 180^\circ$
 - ③ For example, if TDC pointer angle is 35° ,
 the calculation of No.1 Cylinder TDC angle is, $180 - 35^\circ = 145^\circ$
6. Therefore, user input 145° in No.1 Cylinder angle of Setup as TDC.
 Calculate and input setup angle for another cylinder according to cylinder quantity.
 ex) If total cylinder is 7cylinder, each cylinder angle calculation is “ $145 - 196.4 - 299.2 - 350.6 - 42 - 93.4$ “ ($360 \text{ Degrees} / 7 \text{ Cylinders} = 51.4285$)

3.4 ACQUISITION

- ** Important:** Before acquisition Engine Performance Data with MIP3000, must be refrigerate Combustion Sensor when User want to take Engine Performance Data with MIP3000 repeatedly.

3.4.1 Preparation

- 1). Check that the SD memory card is in place.
- 2). Power on the unit by the "ON/OFF" switch located at the top left corner of the unit.
- 3). The "MIP3000" Main Menu will be displayed as in <Fig. 2-3 >.
- 4). Connect the TDC/Teeth sensor cable to the MIP3000 in the left side connection socket at the base of the unit.
- 5). Connect the combustion sensor to the MIP3000 in the right side connection socket at the base of the unit.
- 6). Connect the combustion sensor to the engine at the indicator cock of the cylinder.

3.4.2 Measurement (NEW FILE)

- 1). Press the "ACQUISITION" icon on the Main Menu. < Fig. 2-3 >
- 2). Select Engine Load which want to take data at present Engine Condition or select similar Engine Load which knew by User side in < Fig. 3-4-1 >.
- 3). The message "Will you create a new file?" will be displayed.
- 4). Select "NEW" to create a new engine data file, as is shown in < Fig. 3-4-2 >.



< Fig. 3-4-1 >

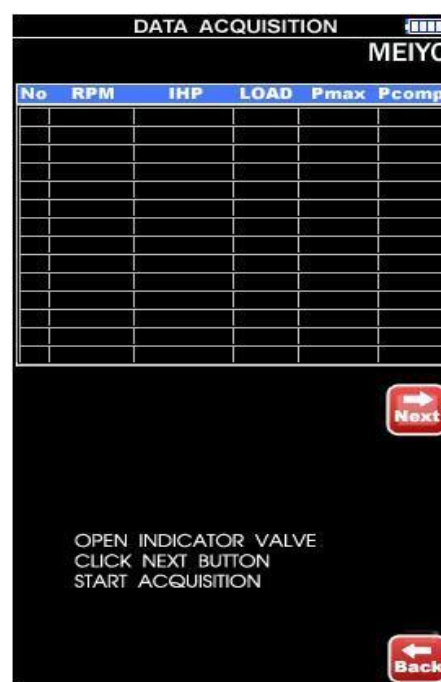


< Fig. 3-4-2 >

5). It will be displayed, which show all cylinders as already selected. <Fig. 3-4-3>




< Fig. 3-4-3 >



< Fig. 3-4-4 >

****NOTE: Any variation of cylinders can now be selected or de-selected with the cursor by pressing on them.**

6). Select all or the desired number of cylinders and press the "Next"  button.


7). The "DATA AQUISITION" screen will be displayed as in <Fig. 3-4-4 >.

****NOTE: If all cylinders are selected for analysis, in case of 6 cylinders in the engine, measuring order is 1→2→3→4→5→6.**

But, only selected no.2, no.3 & no.5 cylinder, measuring order is 2→3→5.

8). "OPEN INDICATOR VALVE" is also displayed at the bottom of the screen at this time.

On the engine itself, open the indicator valve for the cylinder being analyzed.

9). Press "Next" , the MIP3000 will begin sampling the engine data.

10). The sampling data screen will now be displayed as in <Fig. 3-4-7>. As the unit samples and calculates the data, it will be displayed as in <Fig 3-4-8>

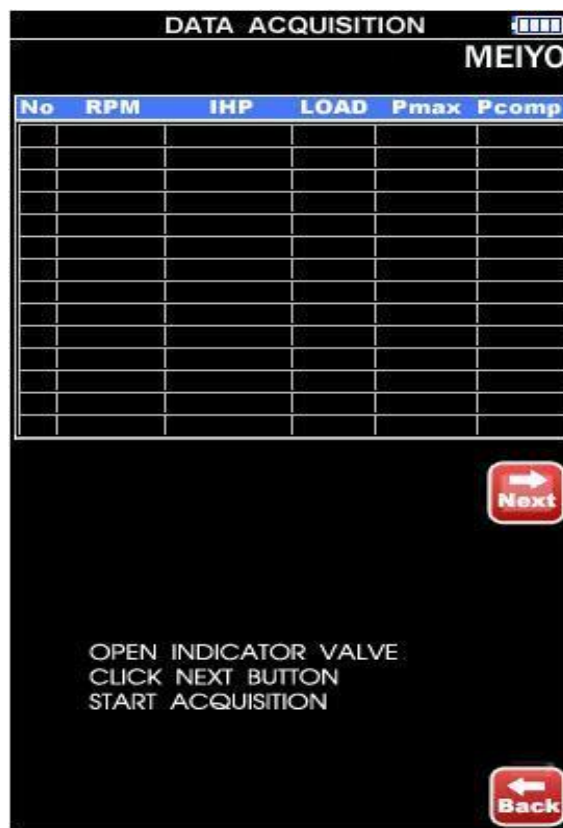
11). When sampling data is complete, the ****CLOSE THE INDICATOR VALVE**** message is displayed. as in <Fig 3-4-8>, then close the indicator valve at this time.

****NOTE: The MIP3000 will take out the highest and lowest load data point values, calculate the average of the remaining eight (8) data point values, and display the calculation in a combustion pressure curve graph.**

12). Press the "NEXT CYLINDER"  button at the bottom of the screen and the "DATA AQUISITION" screen will be displayed again as in <Fig. 3-4-9>.

13). Connect the engine combustion sensor cable to the next cylinder to be analyzed, and

- 14). The message “Will you save acquisition data?” will now be displayed, as in <Fig. 3-4-10> If you will save the data, click “Save”.
- 15). This will show the file that has just been automatically created in list form, with the last file created at the bottom. The unit now saves this data to the SD memory card. If you will not save the data, click “Cancel”.
- 16). If “Cancel” is clicked, the MIP3000 will return to the Main Menu screen and the data will still be automatically saved as MTEST in the SD memory card as shown in the list in <Fig. 3-5-1>.



< Fig. 3-4-6 >

DATA ACQUISITION MEIYO

No	RPM	IHP	LOAD	Pmax	Pcomp

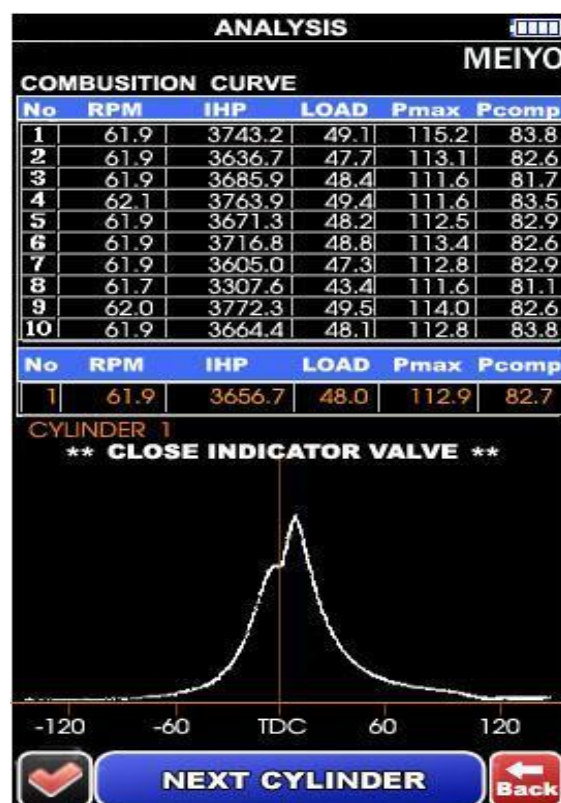
Next

CYLINDER No. 1		CYCLE No. 1	
CHECKED RPM	61.900		
TEETH COUNT	35.000 / 0075		

SAMPLING DATA ...

NEXT CYLINDER

< Fig. 3-4-7 >



< Fig. 3-4-8 >

DATA ACQUISITION MEIYO

No	RPM	IHP	LOAD	Pmax	Pcomp
1	61.9	3656.7	48.0	112.9	82.7

Next

CYLINDER No.		CYCLE No.	
CHECKED RPM			
TEETH COUNT			

NEXT CYL IS NO. 2
CLICK NEXT BUTTON ..

S **NEXT CYLINDER**

< Fig. 3-4-9 >

DATA ACQUISITION MEIYO

No	RPM	IHP	LOAD	Pmax	Pcomp
1	61.9	3656.7	48.0	112.9	82.7
2	61.9	3718.4	48.8	113.3	83.5
3	61.9	3746.4	49.2	114.9	82.8
4	62.0	3715.1	48.7	113.9	82.2
5	61.9	3608.0	47.3	114.0	82.2
6	61.9	3496.6	45.9	113.5	82.1

Will you save the acquired data file ?

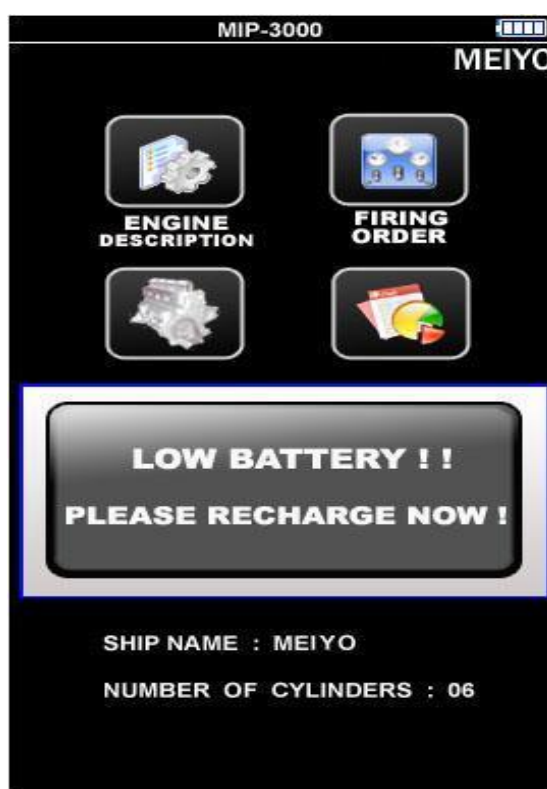
Save **Cancel**

TEETH COUNT	
-------------	--

NO NEXT CYLINDER
NEXT FILE SAVE
CLICK ANY BUTTON ..

NEXT CYLINDER

< Fig. 3-4-10 >



< Fig. 3-4-11 >

****Note:** At any time while in use, if the MIP3000's battery becomes low, a Warning is given as In <Fig. 3-4-11>

3.4.3 Re-check on Operation (Load Function)

1. When happened Mal-Function on Operation same as turn off the power on MIP 3000 or disconnection of signal line (Combustion pressure signal, TDC Signal, Teeth Signal), Try again for acquire Engine data.
2. Connect missed signal line correctly or turn on power switch.
3. Touch "ACQUISITION" Icon on Main Menu and select "LOAD" on <Fig 3-4-1> for calling last file which have measured or stopped file due to abnormal condition of MIP 3000
4. Check acquisition stop Cyl. on data and select being measured Cylinder No. again by function of "USER SELECT"
5. If select Cyl. proceed acquisition sequence accordingly.

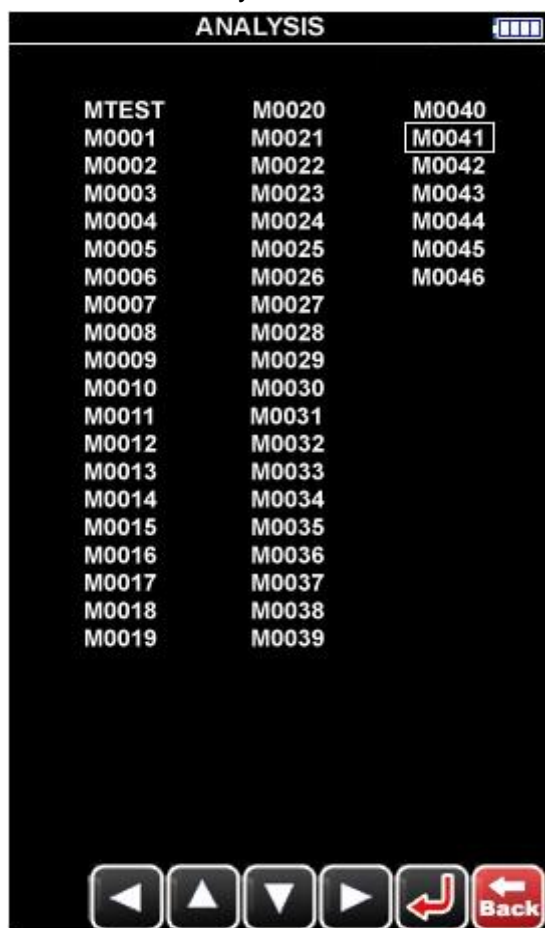
3.4.4 Check working condition of TDC sensor & TEETH sensor by Multi-Tester

1. After took Engine data, if found out bad data in engine data same as below graph (shift graph to one side or separate each cylinder graph), please check signal of TDC sensor & TEETH sensor with below method on Engine running.
2. Prepare Digital Multi Tester which can check Frequency and open the sensor box cover in J/B and connect signal line to MIP 3000.
3. First, check Main Battery Power on/around 11.6 V and check Frequency on No. 2(-) & 3(+) terminal of connection terminal for TDC sensor.
Ex) If RPM is 110 on Engine, then Frequency is $110/60 = 1.83 \text{ Hz}$
4. Then check Frequency on No. 2(-) & 4(+) terminal of connection terminal for TEETH sensor.
If RPM is 110 and Teeth Quantity is 80 pcs on Flywheel.
Ex) Frequency is $110 \text{ RPM} * 80 \text{ TEETH} / 60 \text{ SEC} = 146.67 \text{ Hz}$
5. Please send MIP data file & check result of Step 3 & 4 to our company for analysis & further adjustment.

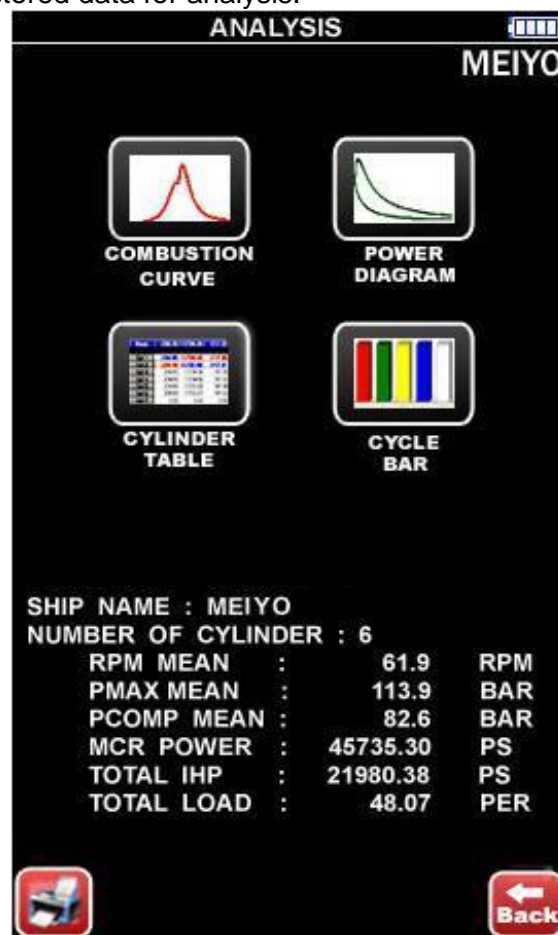
**** Note: If User found out incorrect data after checked the frequency, immediately contact Meiyo electric Co., Ltd. for analysis & further adjustment.**

3.5 ANALYSIS

On the Main Menu< Fig. 2-3>, touch the “ANALYSIS” button and appeared < Fig. 3-5-1 > stored data list from SD memory card and can select any stored data for analysis.



< Fig. 3-5-1>



< Fig. 3-5-2 >

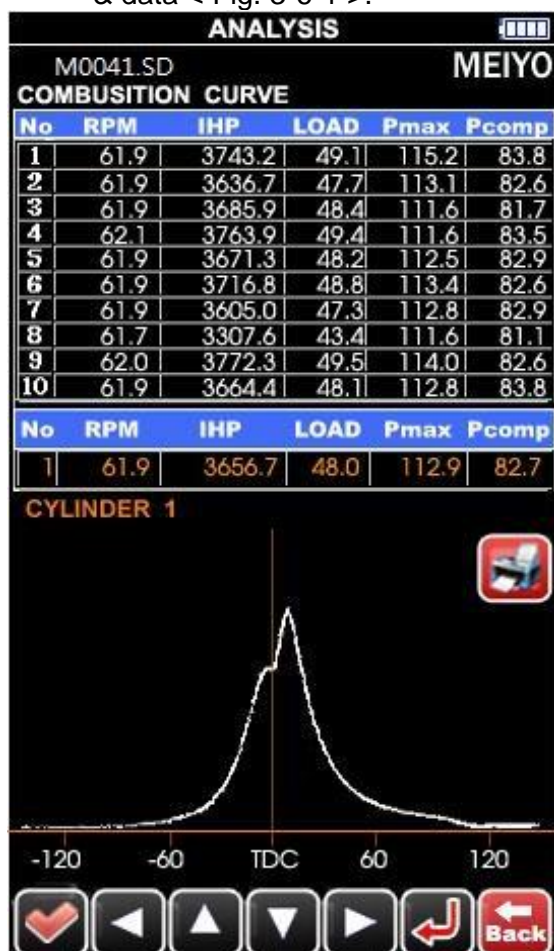
The measured data are shown in various graphs or tables for easy comparison and analysis as < Fig. 3-5-2 >.

< Legend >

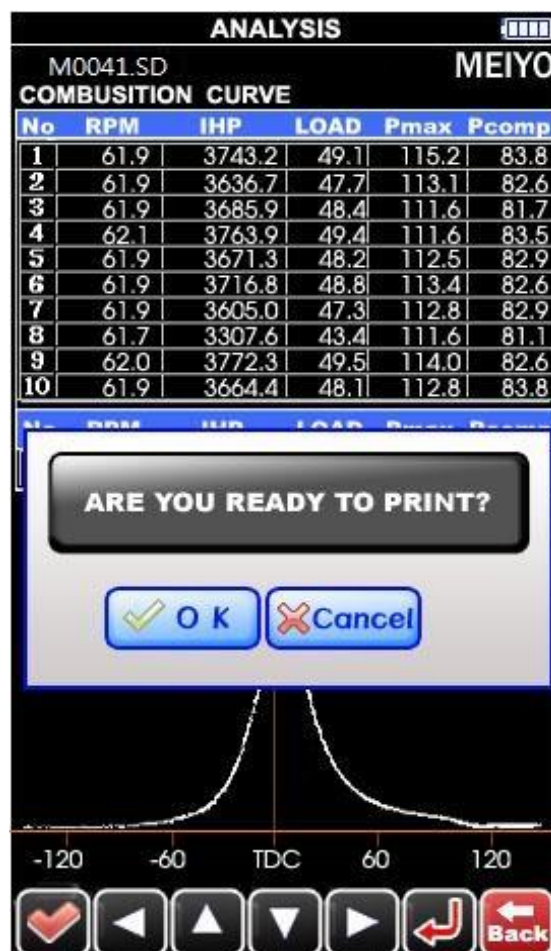
- ◆ IHP : power of each cylinder
- ◆ LOAD : working load on engine at the time of measurement
- ◆ Pmax : maximum combustion pressure inside cylinder
- ◆ Pcomp : compression pressure at TDC
- ◆ Diff : difference between Pmax and Pcomp
- ◆ MIP : mean indicated pressure

3.5.1 Combustion Curve






1. Touch "COMBUSTION CURVE" button on < Fig. 3-5-2 > and will appear below curve & data < Fig. 3-6-1 >.








< Fig. 3-6-1 >



< Fig. 3-6-2 >

2. The curve and attributes of each cylinder are shown with values which help the user to figure out the status of combustion.
3. If a direct thermal printing printer (option) is connected to the MIP3000, if user touch MIP3000's PRINT button  on screen, the curve and attributes of current cylinder are printed by a direct thermal printing printer. < Fig. 3-6-2 >
4. Select the cylinder number using the UP/DOWN ARROW keys   on below side of screen, and touch ENTER button .
5. MIP3000 is shown mean values on screen with Cyl. No. which cut Max. & Min. column based on IHP out of 10 RPM measured data.
6. After checking the data, touch "BACK" button  for return to the "ANALYSIS" window.





3.5.2 Power Diagram

1. Touch "POWER DIAGRAM" button on < Fig. 3-7 >.
2. The curve and attributes of each cylinder are shown with values which help the user to figure out the status of combustion.
3. If a direct thermal printing printer (option) is connected to the MIP3000, if user touch MIP3000's PRINT button  on screen, the curve and attributes of current cylinder are printed by a direct thermal printing printer. < Fig. 3-7 >
4. Select the cylinder number using the UP/DOWN ARROW keys   on below side of screen, and touch ENTER button .
5. MIP3000 is shown mean values on screen with Cyl. No. Which cut Max. & Min. column based on IHP out of 10 RPM measured data.
6. After checking the data, touch "BACK" button  for return to the "ANALYSIS" window.



< Fig. 3-7 >

3.5.3 Cylinder Table

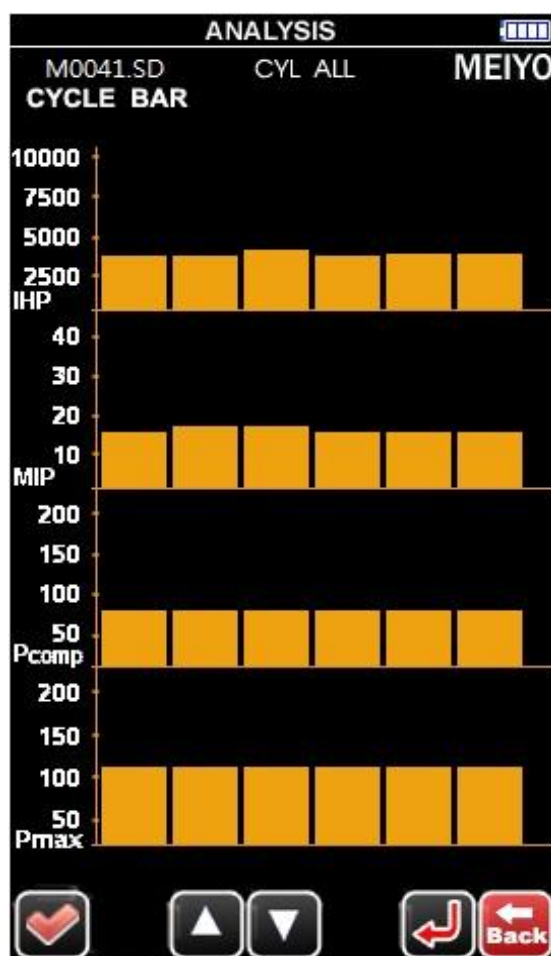
1. Touch the “CYLINDER TABLE” button for calling out all cylinders’ mean value data from SD memory card. < Fig. 3-8 >.
2. If a direct thermal printing printer is connected to MIP3000, if user press MIP3000’s print icon , each cylinder mean data values are printed by a direct thermal printing printer.
3. “CYLINDER TABLE” shows the data for all cylinders which took from Engine and help the user to figure out the condition of the Engine Condition in more detail.
4. Use LEFT/RIGHT ARROW buttons   for show more data about DIFF. & MIP.
5. After checking the data, touch “BACK” button  for return to the “ANALYSIS” window.



< Fig. 3-8 >

3.5.4 Cycle Bar

1. When touch the “CYCLE BAR” on analysis screen, appear cylinder bar graph which compared with each cylinder or cycles.<Fig. 3-9>
2. “CYCLE BAR” shows the data for cylinders or compared data for each cylinder which helps the user to figure out the condition of the cylinder in more detail.
3. “CYCLE BAR” helps comparison of each cylinder.
4. Pmax, Pcomp, MIP, and Power are shown in a bar chart which helps the user to figure out the difference between the cylinders.



<Fig. 3-9>

3.6 P C Upload

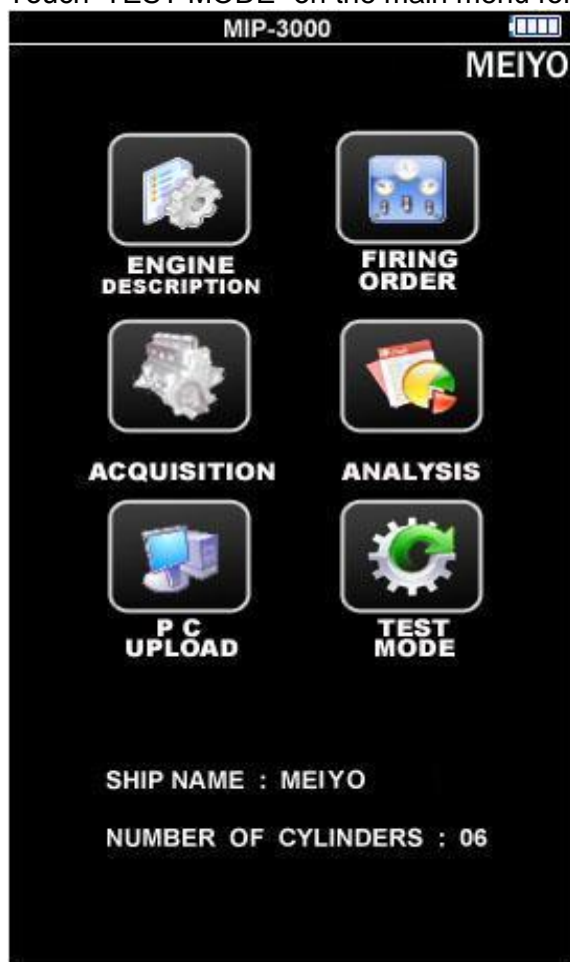
For data transfer from MIP3000 to PC, please refer manual of MIP3000 Windows Program Section, 9. Transfer (P. 56).

***Remark: Use SD Card Reader when upload measured Data from MIP3000 to PC.**

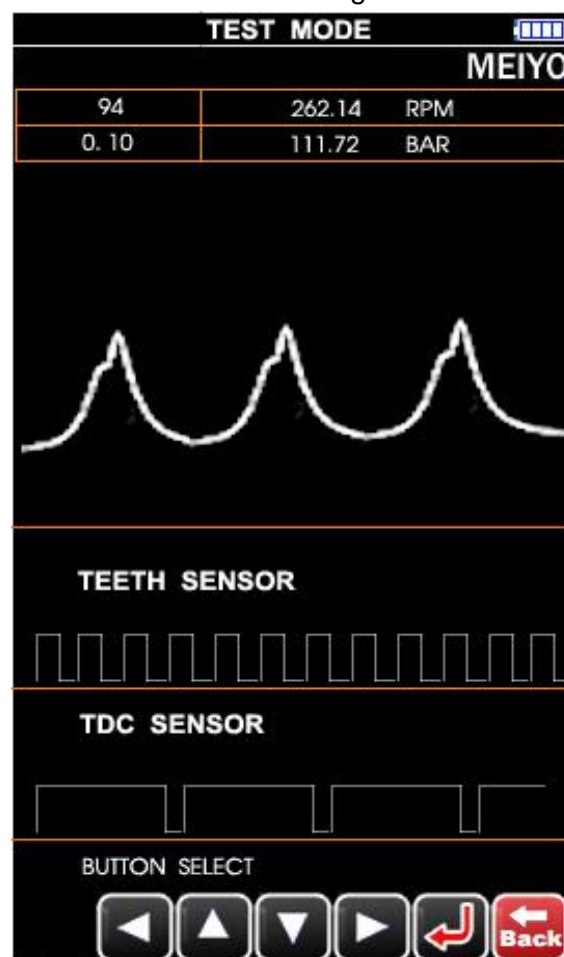
3.7 Test Mode

Test Mode enables the user to test each function of the MIP3000 System.

Touch 'TEST MODE' on the main menu for enters to test mode screen< Fig. 3-12 -1>.



< Fig. 3-12-1 >




< Fig. 3-12-2 >

1. The TEST MODE screen is displayed as in < Fig. 3-12-2 >.

From this screen, the following can be immediately monitored by number which marked by red box & graphs according to Engine Signals:

- RPM..... 262.14
- Number of Teeth..... 94
- Peak Combustion Pressure Graph..... 111.72
- Magnifying Ratio..... 0.10
- TDC signal for ENCODER
- TEETH signal for ENCODER

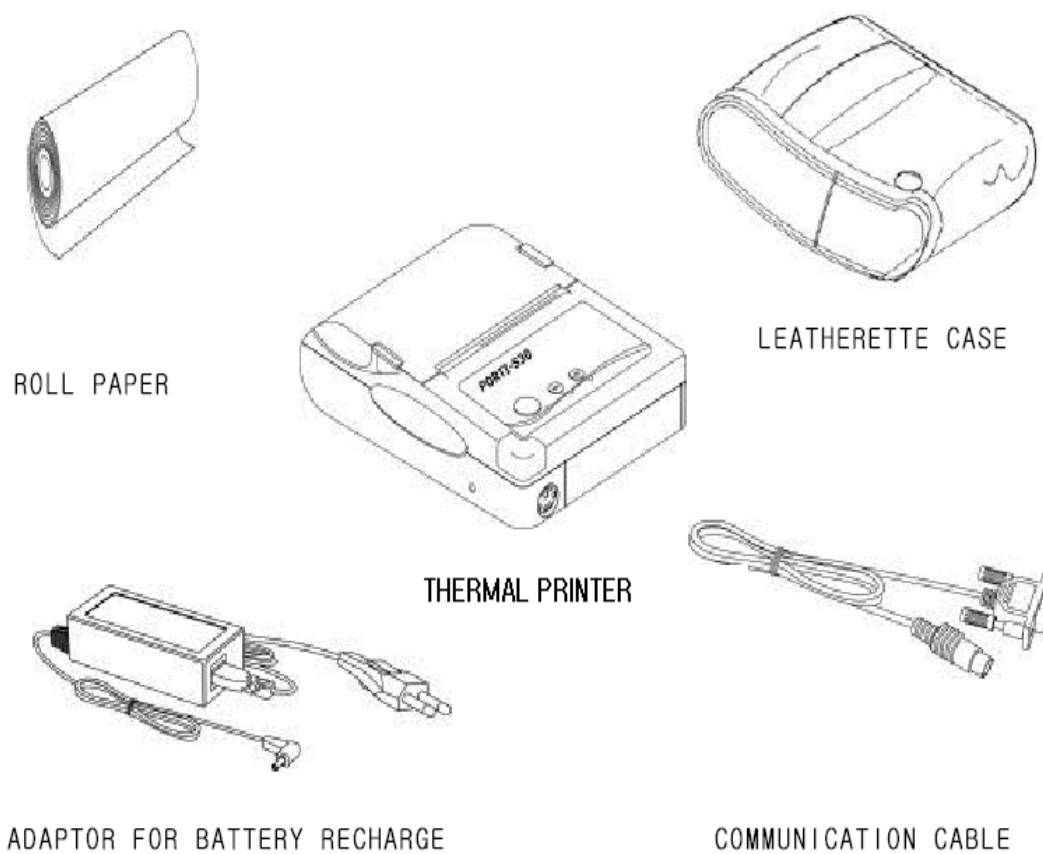
2. Additionally, the TDC & TEETH signal graph can be magnified by adjusting the Magnifying ratio at the left hand top side of the screen, by touching up/down arrow keys when appear "BUTTON SELECT" in order to check any missing signal.

3. Press the "Back" button  to return to Main Menu when appear "Button select ".

4. In the event of check sensor signal condition at Test Mode, the user can confirm correct working of sensors by checking No. of “Flywheel Teeth “ and Engine RPM which compared with Setup data & actual Engine RPM.
5. In the event that deviations are found in No. of “Flywheel Teeth “and Engine RPM, Please refer 4.2 Trouble Shooting – General at Page 40.”

4. Thermal printer (Option)

4.1 Thermal printer configuration

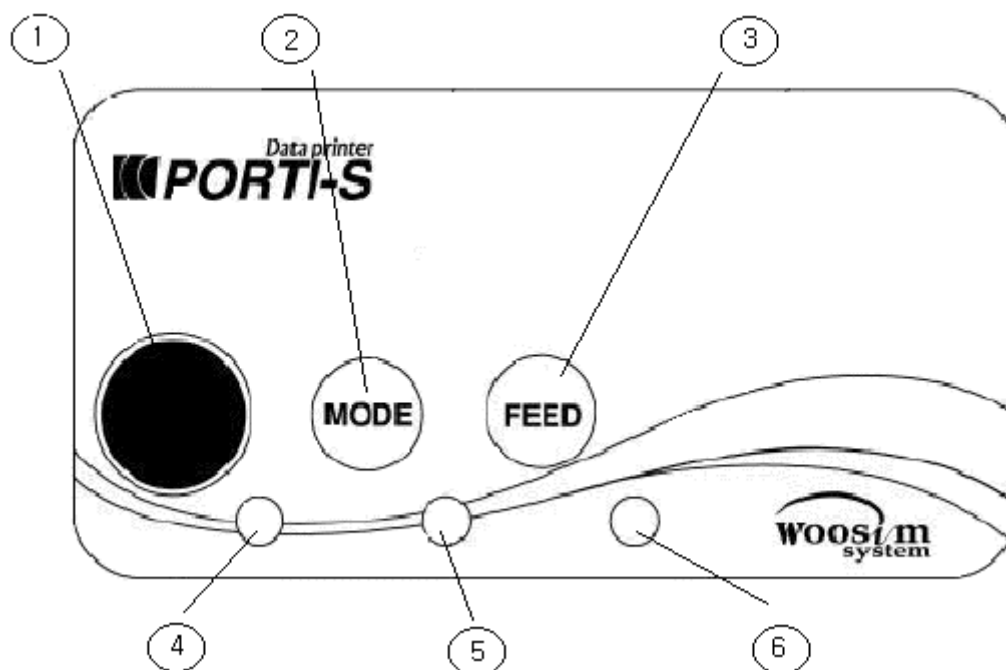


< Fig 4-1 >

4.2 Thermal printer Specification

- Resolution : 203dpi : 8dots/mm
- Size : 75 X 103 X 34mm
- Weight : 250g
- Power : 7.2V DC 880mA Nickel-Metal Hydride battery
- Battery duration : 1 Hour continuous printing
- Printing speed : 50mm/sec
- Adapter : AC 85~240V Input / 8.6V DC
- Operating temperature : 0 ~ 40 °C
- Communication : RS232C
- Full charge time : 4 Hours

4.3 Thermal printer Keypad



< Fig 4-2 >

- ① Power Button: used to turn on or turn off the power.
- ② Mode Button : used to change communication mode
- ③ Feed Button: press the Feed button once to advance paper one line. You can also hold down the Feed button to feed paper continuously.
- ④ Power Lamp: the power lamp is on whenever the printer is on. But when the battery is almost exhausted, this led flashes with red color occasionally. In this case, you must recharge the battery by using the adapter.
- ⑤ Error Lamp: this indicates an error such as paper end, or cover open, mode conversion etc.
- ⑥ Data Lamp : the data lamp is on whenever the printer receives data to MIP3000

5. Notes & Trouble Shooting

5.1 Notes

5.1.1 Battery & Battery Charger

* MIP3000 can be use for about 10 hours by 3.5 hours Battery charging.

The battery can be charged & discharged for about 500 times.

Full discharge the battery doesn't help to extend battery life.

- ① Main power switch (upper side) ON.
- ② Connect the charger to Adaptor jack of the upper side in MIP3000.
- ③ Light the green LED "BAT" on the key-pad.
- ④ After 3.5 hours, Light off the green LED "BAT" on the key-pad. (Full charging)
- ⑤ If completed charging, you can use about 10 hours with a battery.
- ⑥ When you do not use MIP3000, turn Off the Main Power S/W. (Upper side)

If not, battery will be discharged.

5.1.2 Power Source

- ① After full charge, Turn on the Main Power switch which is located at upper side of MIP3000.
- ② Then red LED "PWR" will turn on and After LCD monitor is lighted, then check the working condition of key pad & touch screen.

5.1.3 Combustion Sensor

- ① Choose "TEST MODE" on the "MAIN MENU"
- ② Install the Combustion Sensor at the running Engine's Indicator valve and Open the valve.
- ③ According to the pressure which input from combustion sensor, The pressure appear on the screen in real-time on "TEST MODE". <Fig. 3-12-2>.
- ④ If output is abnormal (ex. Continuously 0.00 bar), Check the combustion sensor connector and MIP3000 connector. And then re-check for the output.

Nevertheless, you follow these procedures on above, if MIP3000 does not operate normally, please contact to Meiyo Electric Co., Ltd. By E-mail or something. We will take appropriate action as soon as possible.

- ⑤ If output is abnormal (ex. Continuously 249.9 bar), Check the acquisition graph whether insert noise to system or not and if take same condition when take acquisition again for 1 cyl., There is possibility that combustion sensor burned out due to high temperature.
In this case, please contact to Meiyo Electric Co., Ltd. By E-mail or something. We will take appropriate action as soon as possible.

5.1.4 TDC/TEETH sensor

- ① Check connector of the MIP3000's TDC/TEETH cable.

During the measurement, If "TDC SENSOR ERROR OR ENGINE STOP" or "TEETH SENSOR ERROR OR ENGINE STOP" appears, check for the state of connection cables.

- ② Check for TDC/TEETH sensor cable, whether damaged or not.

- ③ Check for TDC/TEETH Sensor

It can be inspected in case that M/E is in operation or Flywheel is in revolution by Turning-gear. Connect TDC/TEETH Sensor Cable to MIP3000, and then Power ON.

If there is a neighboring object nearby sensor, light the LED of TDC/TEETH Sensor body.

In case that LED on the sensor body is not lighted, there is possibility that sensor was broke down.

- ④ Check for the Gap of TDC/TEETH sensor

The sensor on the bracket can be loosening by vibration and shock.

If Gap becomes wider or narrower than initial gap (4.0 ~4.5 mm), adjust again according to instruction book.

5.1.5 Accuracy check

- ① MIP3000 have adjusted by different pressure value (0~250 bar) & Temperature value (-40~125℃) at Maker's Workshop.

- ② MIP3000 should be carrying Pressure Calibration once a year by Maker even though MIP3000 has no pressure difference when check by pressure calibrator at User`s workshop.

** At User`s workshop, User can use your standard pressure calibrator.

- ③ The standard Accuracy of the MIP3000 are ± 1.0 % Full Scale(0~250 bar) at temperature range (-40~125℃) and if pressure difference are over ± 1.0 % Full Scale by Pressure Calibrator, we recommend to send MIP3000 to Maker`s Workshop for adjustment & calibration.

In this case, Maker will submit new Calibration Certificate to User.

5.1.6 Cleaning

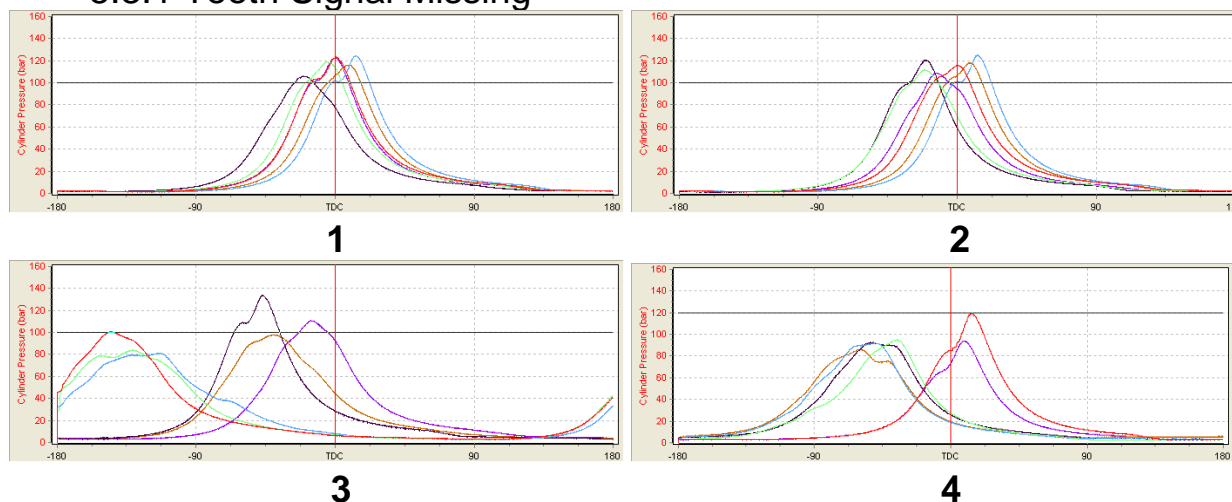
Clean the gas channel of Thompson Adaptor & Combustion Pressure Sensor by compressed air after completion of requisition of Engine.

5.2 Trouble Shooting for General

Part	Symptoms	Check Point
Power Source	* MIP3000 doesn't work	* Charge the battery fully. * Check Main Power switch (MIP3000's upper side)
Touch Screen	* Power ON, but displayed nothing	* Charge the battery fully. * Check Main Power switch (MIP3000's upper side) * Contact Maker
M/E ACQUISITION	* Graph mal-function * Cannot take correct data Graph	* Check combustion sensor condition * Took data again for confirmation **Refer next sample data graph & it's solution
Analysis	* Data doesn't changed on screen	* Press "ENTER" button for each cylinder on touch screen or keypad. * Try again with touch pen.
Data Communication	* Data doesn't transfer.	* Check the data cable. (damage/connect firmly) * Confirm COM port on set * Select transfer file again by touch pen
Test Mode	* Don't display combustion sensor pressure * Don't display TDC/Teeth sensor pulse * Don't display Teeth Quantity * Don't display RPM	* Check Indicator Cock valve & check connection of Combustion sensor * Check clearance of TDC/Teeth sensor and pulse signal of TDC/Teeth sensor by Multi-Tester
Thermal printer	* Printer doesn't work * Cannot printout	* Charge the battery. * Check the cable connection. * Check the paper whether remaining or not. * Close the paper cover firmly.

5.3 Trouble Shooting for Acquisition Mal-Function

5.3.1 Teeth Signal Missing



Condition: Small movement & pressure drop on acquisition graph (1 & 2)

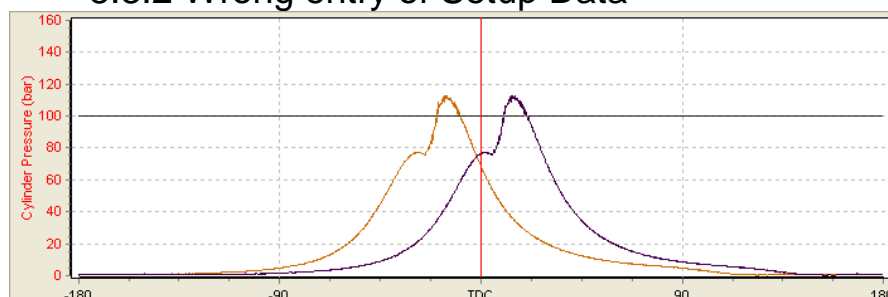
Moved graph with big angle and have pressure drop with big difference (3 & 4)

Cause: Changed Teeth sensor clearance or vibrated Teeth Sensor Bracket

Count-Measure: 1) Need re-adjusted Teeth Sensor clearance

2) Welded additional bracket to Teeth Sensor Bracket

5.3.2 Wrong entry of Setup Data

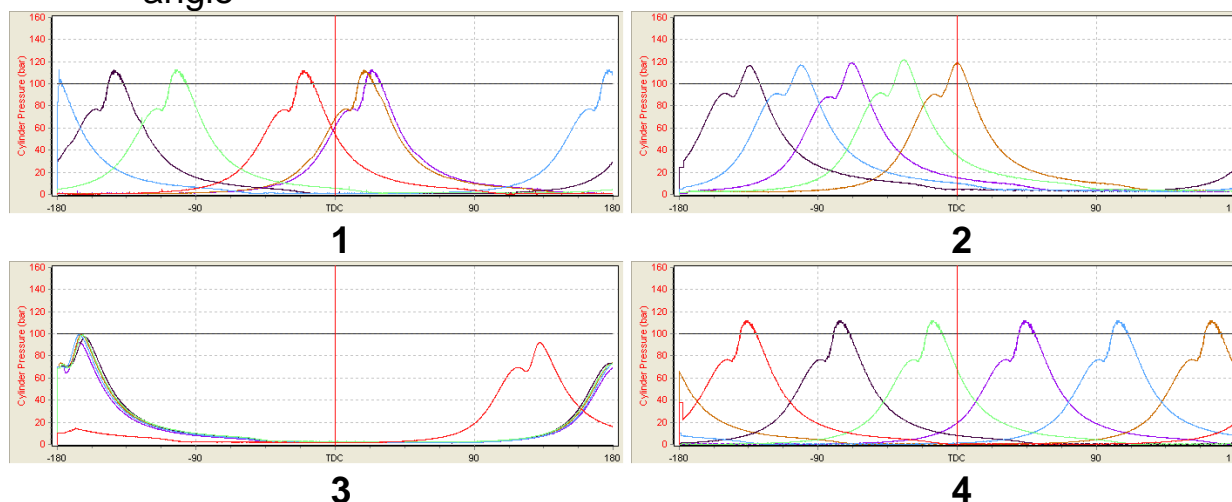


Condition: Shifted graph of 1 ~ 2 Cyl. From TDC normal position

Cause: wrong data entry at Setup Data Crank angle

Count-measure: 1) Confirmed TDC Pin position and Re-entered Crank Angle

5.3.3 Wrong place of TDC Pin or wrong data entry to Setup Data crank angle



Condition: Moved graph by same interval for each Cyl. (2 & 4)

Moved graph to other side or dispersed each Cyl. (1 & 3)

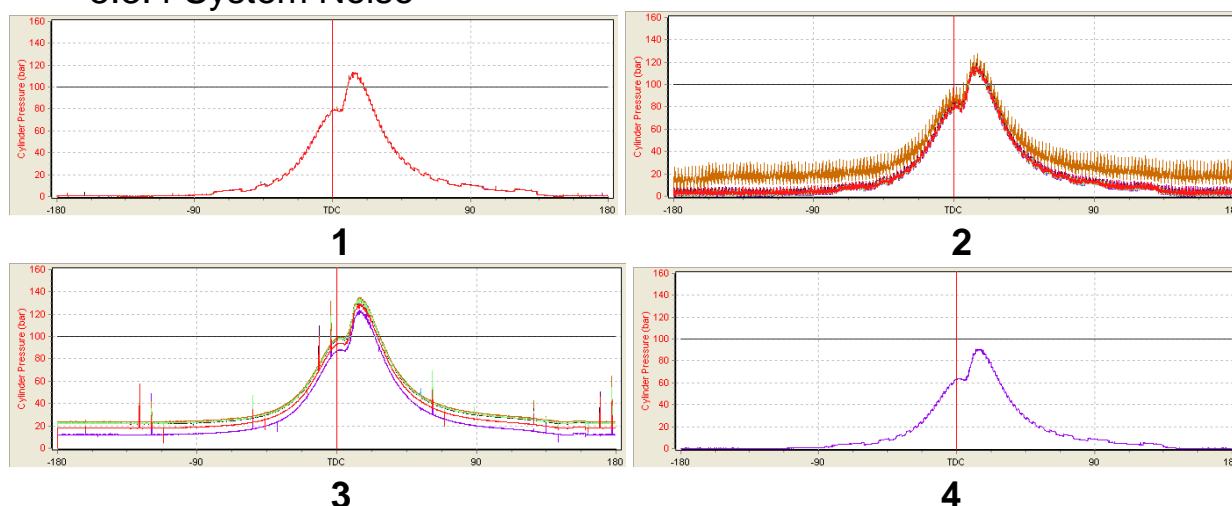
Cause: Installed TDC Pin at Wrong place or wrong data entry at Setup Data Crank Angle

Count-measure: 1) Re-adjusted TDC Sensor Clearance

2) Confirmed TDC Pin position and Re-adjusted TDC Point

3) Confirmed TDC Pin position and Re-entered Crank Angle

5.3.4 System Noise



Condition: Make angle of graph when acquisition (1 & 4)

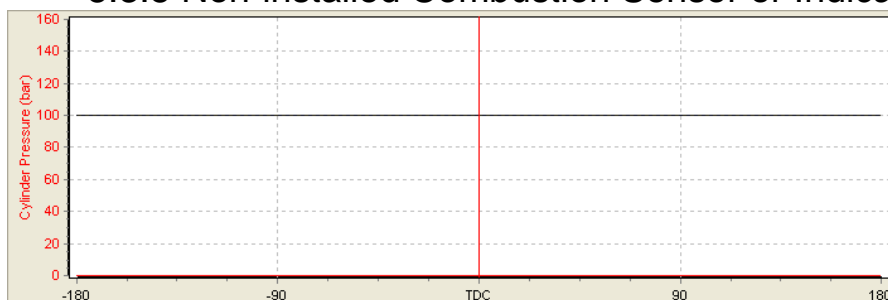
Make vibration & make noise on graph (2 & 3)

Cause: interference of Electro wave in internal & external circuit of system

Count-measure: 1) Installed condenser for reduce Noise on PC Board of MIP3000

2) Should be carried out by Maker – return MIP3000body to Maker

5.3.5 Non-installed Combustion Sensor or Indicator valve close

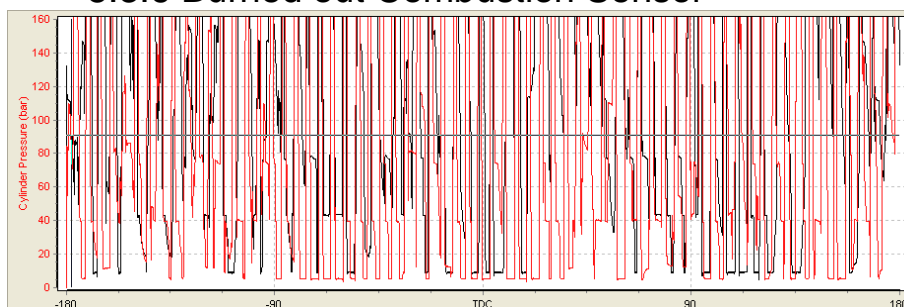


Condition: No display pressure graph on screen

Cause: Took graph with Non-installed Combustion Sensor or Indicator valve close

Count-Measure: 1) Acquisition after Installed Combustion Sensor and open Indicator Valve

5.3.6 Burned out Combustion Sensor



Condition: Not display pressure graph and display only noise

Cause: Burned out Combustion Sensor (exposure excessive heat)

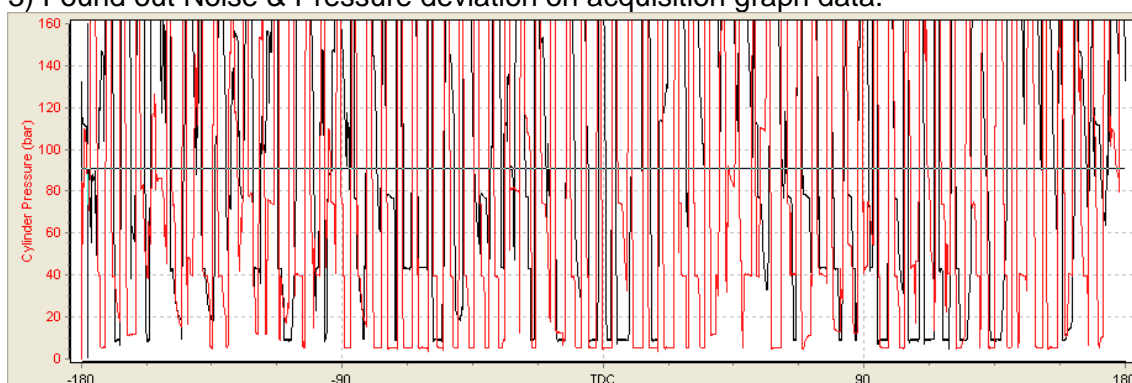
Count-Measure: 1) Took Combustion pressure graph of 1 Cyl. For confirm Combustion Sensor and if have same condition, request new Combustion Sensor to Maker.

5.4 Technical Information

Subject: Combustion Sensor Trouble

1. Condition: Took different Acquisition data or Error message on MIP3000 when took Combustion data with MIP3000.

- 1) Appeared RPM Error Message with wide variable RPM data.
- 2) Displayed over max pressure 250 bar on acquisition data.
- 3) Found out Noise & Pressure deviation on acquisition graph data.



2. Cause of Trouble: Broken inner circuit of Sensor PCB when took acquisition data with excessive expose to combustion pressure in Cyl. & Combustion heat to Combustion Sensor of MIP3000.

- 1) Combustion pressure in Cyl. & Combustion heat transferred to Combustion Sensor at second hand through pipe of Indicator valve. So Combustion Sensor can stand to combustion pressure in Cyl. & Combustion heat. But Combustion Sensor has possibility which will overheat due to long Acquisition time.

3. Attention & Countermeasure:

First of all, when took Acquisition data with MIP3000, Engineer proceed acquisition works according to order of MIP3000 screen which keep his composure.

- 1) Proceed Acquisition of MIP3000 according to order of MIP3000's Screen (Open/Close the Indicator Valve, Click next Button & etc).
- 2) If overheat Combustion Sensor when took data continuously for one Cyl. Please precede next Acquisition after cool down combustion Sensor.
- 3) In case of took data continuously for one Cyl., can happen trouble of Combustion Sensor due to overheat of Combustion Sensor & Pulsating Combustion Pressure.
- 4) If happen overheat trouble to Combustion Sensor, Maker cannot repair Combustion Sensor

due to disconnect sensor line between Inner circuit of PC Board and Combustion Sensor.

In this case, Customer should be purchase new Combustion Sensor.

- 5) When repair with new Combustion Sensor, Ship or User should be dispatch MIP3000 main body including troubled Combustion Sensor set to Maker for check & re-calibration between MIP3000 & new Combustion Sensor

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