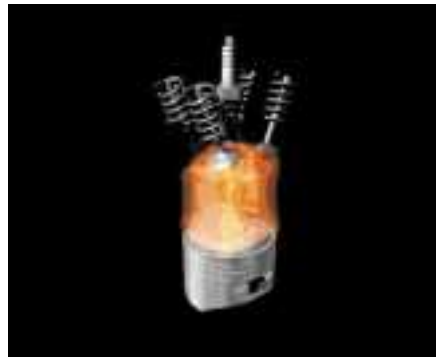




Application Software Package for Analysis of Engine Combustion Pressure



Contents



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Features

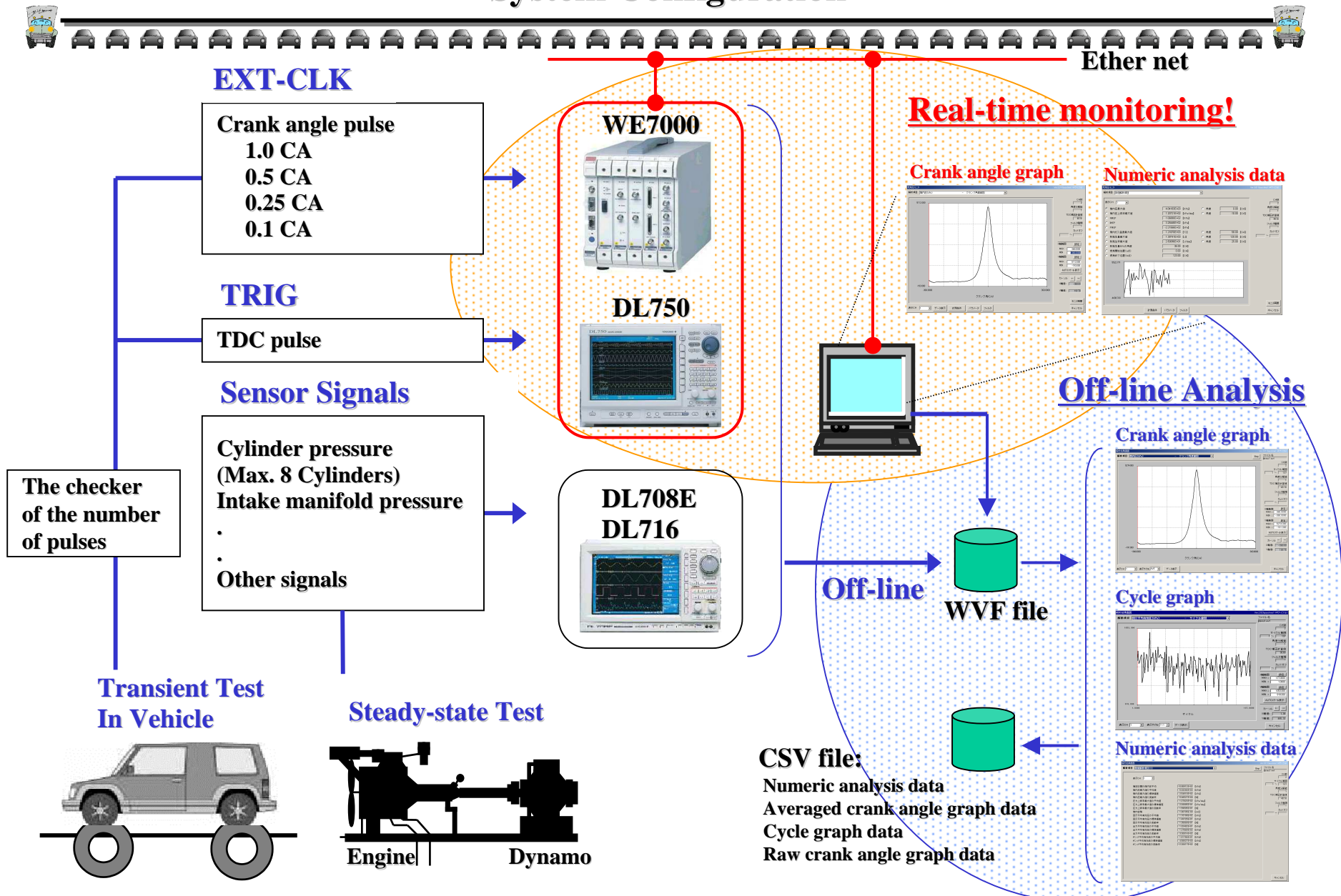


Suitable For The In – Vehicle Test

- 1. Built-in library of core analysis functions for the Pressure, Temperature and Heat release, etc.**
- 2. It is available for the Gasoline, Diesel and LPG/LNG Engine.**
- 3. It will handle both the 2-cycle and 4-cycle engine.**
- 4. It operates on Windows (95/98(Me)/NT/2000/Xp).**
- 5. High Cost Performance, starting from \$8,300.- (including hardware)**



System Configuration



Modules for Combustion Analysis



| | DL708E 701853 | DL750 701251 | WE7000 707272 | WE7000 707275 |
|--------------------------------------|--|--|--|--|
| Module | Isolated 2-Channel Module | Isolated 2-Channel Module | Isolated 4-Channel Module | Isolated 2-Channel Module |
| Slot Input channel | 8 slots 8CH | 8 slots 16CH | 4 slots 16CH | 8 slots 16CH |
| Maximum sampling rate | 100KS/s | 1MS/s | 100KS/s | 1MS/s |
| A/D conversion resolution | 16Bit | 16Bit | 16Bit | 14Bit |

Relation between a sampling rate and the measurement range

100KS/s • 0.5CA - about 8000rpm 0.1CA - about 1600rpm
1MS/s • 0.5CA - about 80000rpm 0.1CA - about 16000rpm



Input Data



1. Measuring signals

Max. 16CH

| | |
|-----------------------------|-------------------------|
| Cylinder pressure | Max. 8CH(8 cylinders) • |
| Intake manifold pressure | 1CH |
| Intake manifold temperature | 1CH |
| Fuel consumption | 1CH |
| Revolutions per minute | 1CH |
| Other signals | Max. 15CH |

2. Crank angle pulse

1.0CA, 0.5CA, 0.25CA, 0.1CA

3. Number of cycles

Max. 800 cycles.

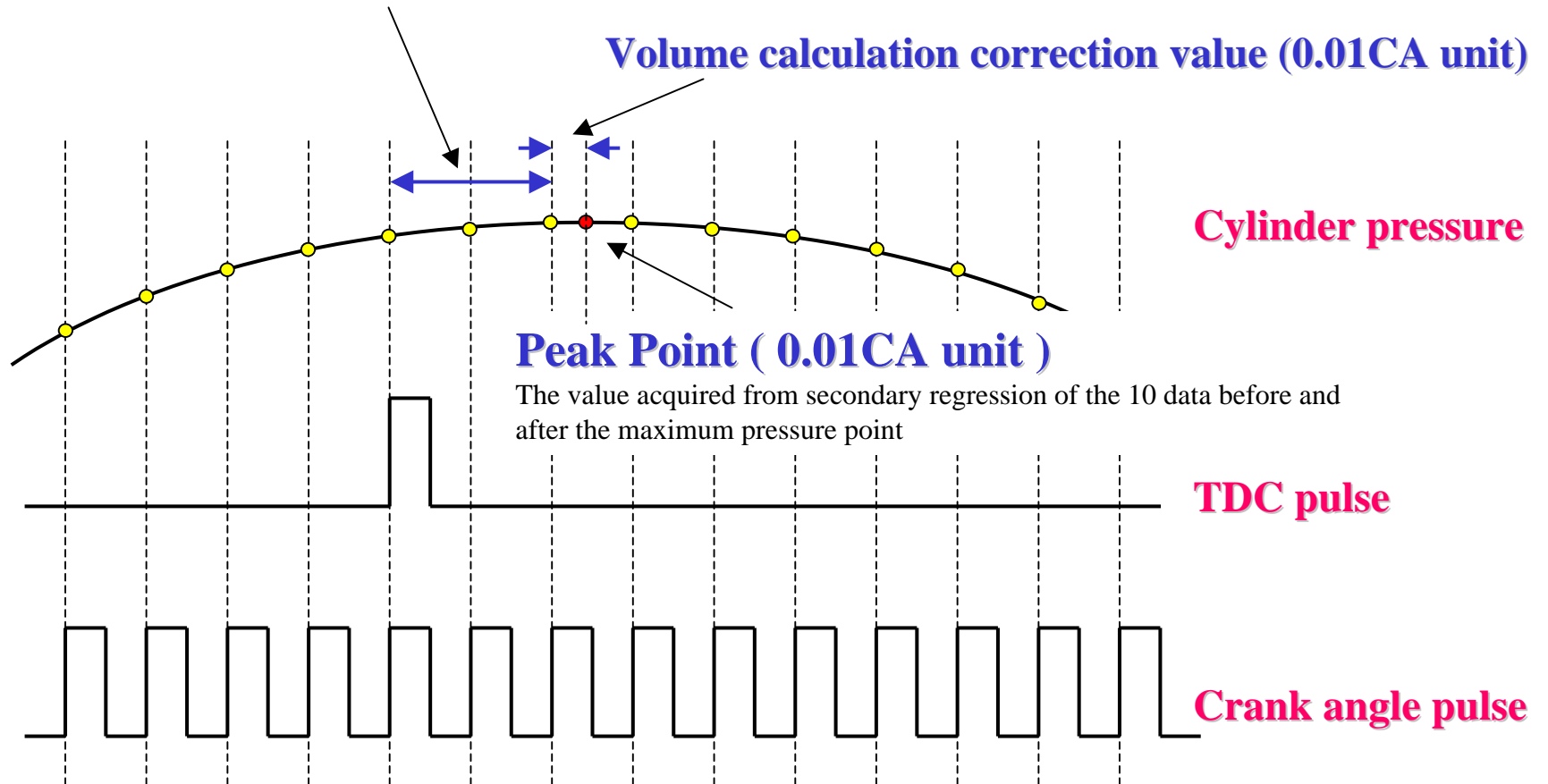
You can divide measured data of up to 25000 cycles into divisions of arbitrary size (up to 800 cycles), and perform analysis.



TDC Correction



TDC correction value(current angular resolution)

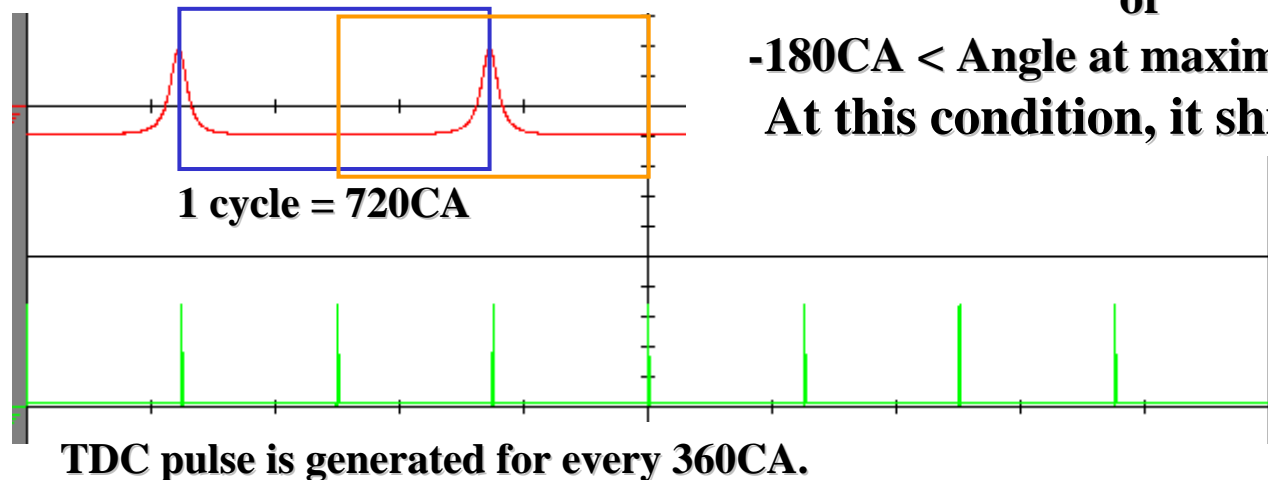


Rotation and Cylinder to Cylinder Offset Correction



There is a possibility to get the 1/2 cycle lag in the 4 cycle, Intake – Compression – Power (Ignition) – Exhaust because we use one pulse per revolution like a TDC pulse as a trigger.

1. Rotational offset correction



Angle at maximum pressure $< +180\text{CA}$
or
 $-180\text{CA} < \text{Angle at maximum pressure}$
At this condition, it shifts 360CA.

2. Cylinder-to-cylinder offset correction

Offset angle = $720\text{CA} / \text{Number of cylinders}$



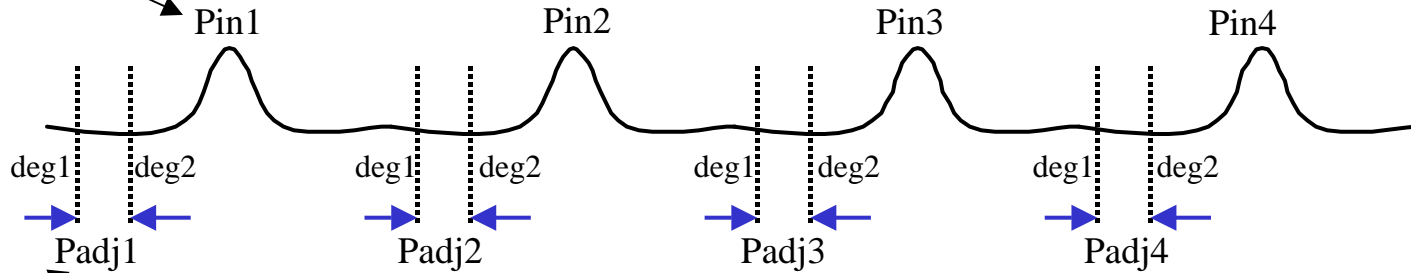
Absolute Pressure Correction



Method 1 : By using of averaging value of each cycle

$$P_n = Pin_n - Padj_n + P_{X_n}$$

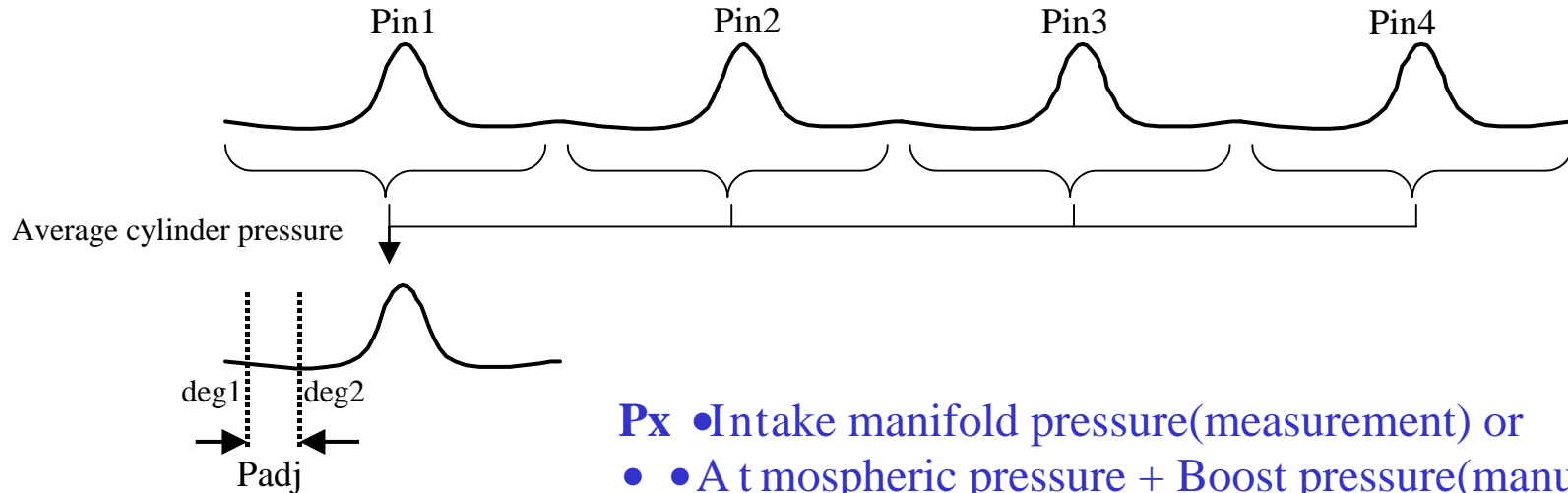
Cylinder pressure



Average pressure between deg1 and deg2

Method 2 : By using of averaging value of all cycles

$$P_n = Pin_n - Padj + P_{X_n}$$



- P_x • Intake manifold pressure(measurement) or
- • A t mospheric pressure + Boost pressure(manual input)



Engine and Other Parameters for Setup



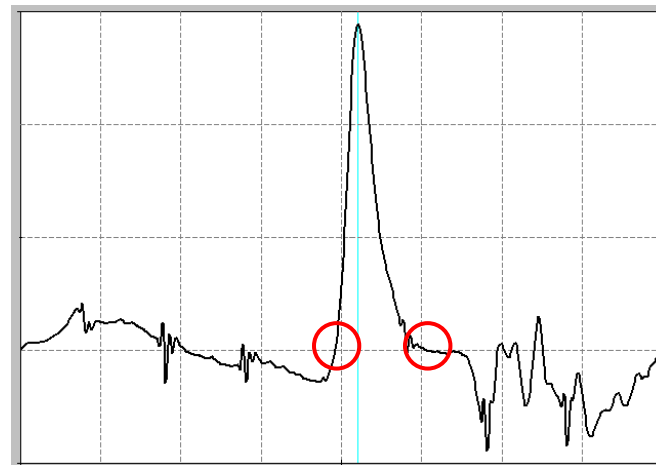
- Con-rod length (mm)
- Bore diameter (mm)
- Piston offset (mm)
- Stroke length (mm)
- Clearance volume (cm³)
- Compression ratio

- Suction volumetric efficiency(%)
- Revolutions per minute (rpm)
- Gas constant(* 9.80665 J/kg.K)
- Fuel consumption(cm³/sec)
- Specific gravity(g/cm³)
- Ratio of specific heat
- Atmospheric pressure (kPa)
- Boost pressure (kPa)
- Atmospheric temperature (deg C)

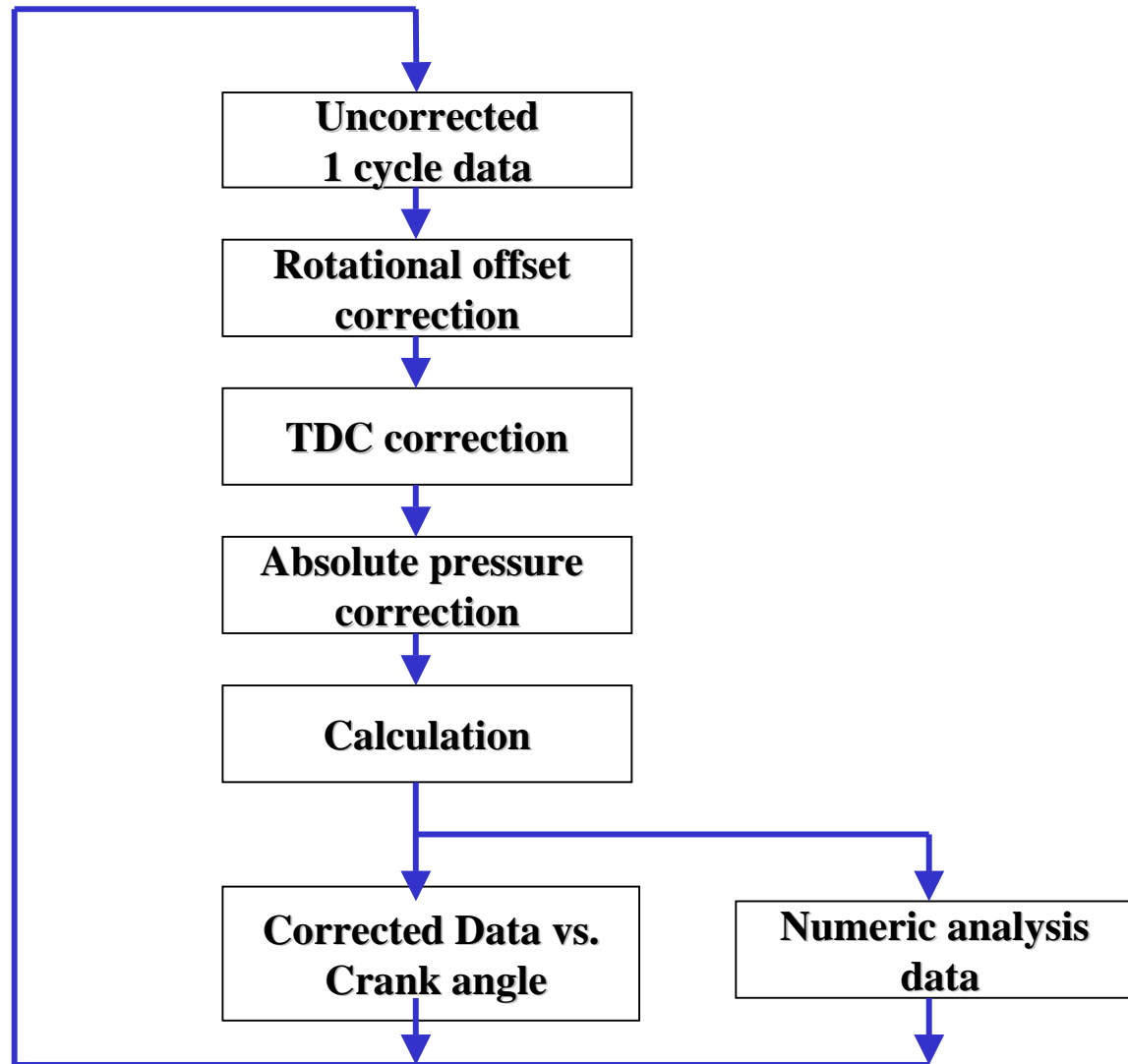
- Ratio for judging angle of Combustion mass rate N%(%)
- Absolute pressure correction method
- Number of data items for judging start point and end point of combustion

When the value of N points is positive continuously before dQmax, the first angle which just changed to positive is made into the start point of combustion.

When the value of N points is negative continuously after dQmax, the first angle which just changed to negative is made into the end point of combustion.



Sequence of On – Line Real Time Monitoring



Crank Angle Graph at On – Line Real Time Monitoring

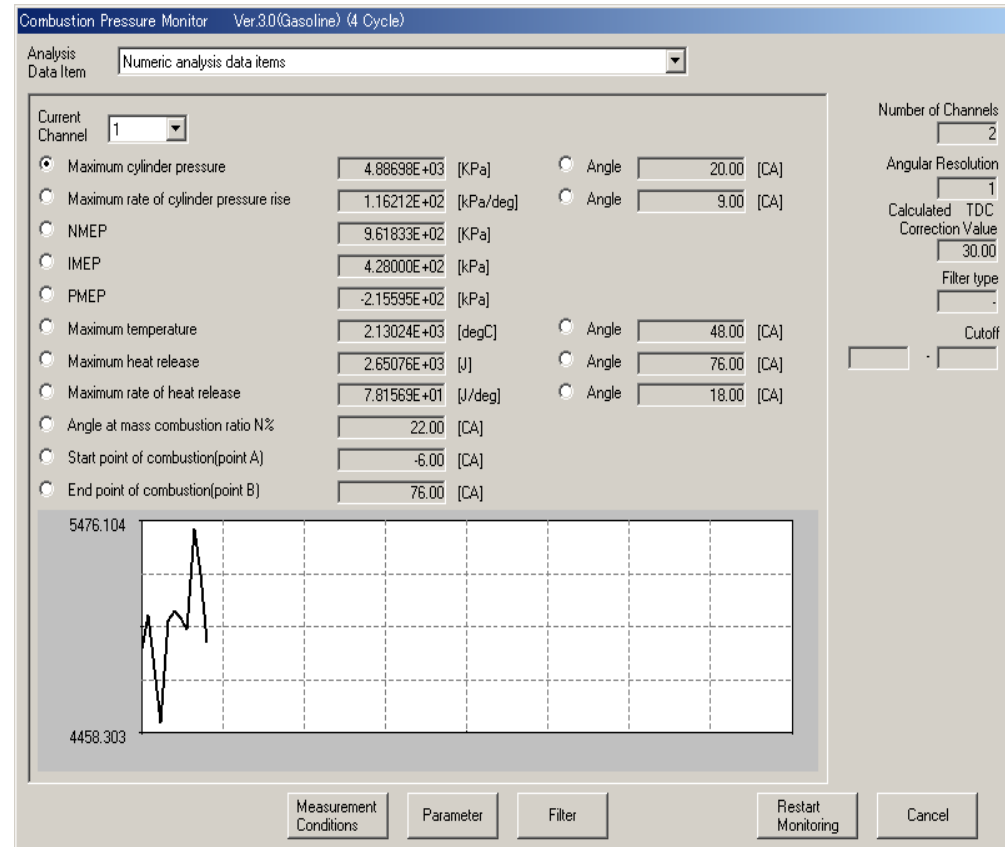


- **Cylinder pressure - Crank angle graph**
- **Rate of cylinder pressure rise - Crank angle graph**
- **Cylinder pressure - Piston displacement graph**
- **Amount of heat release - Crank angle graph**
- **Rate of heat release - Crank angle graph**
- **Combustion mass rate - Crank angle graph**
- **Cylinder gas temperature - Crank angle graph**
- **Other signals - Crank angle graph**

Numeric Analysis Data Items at On – Line Real Time Monitoring



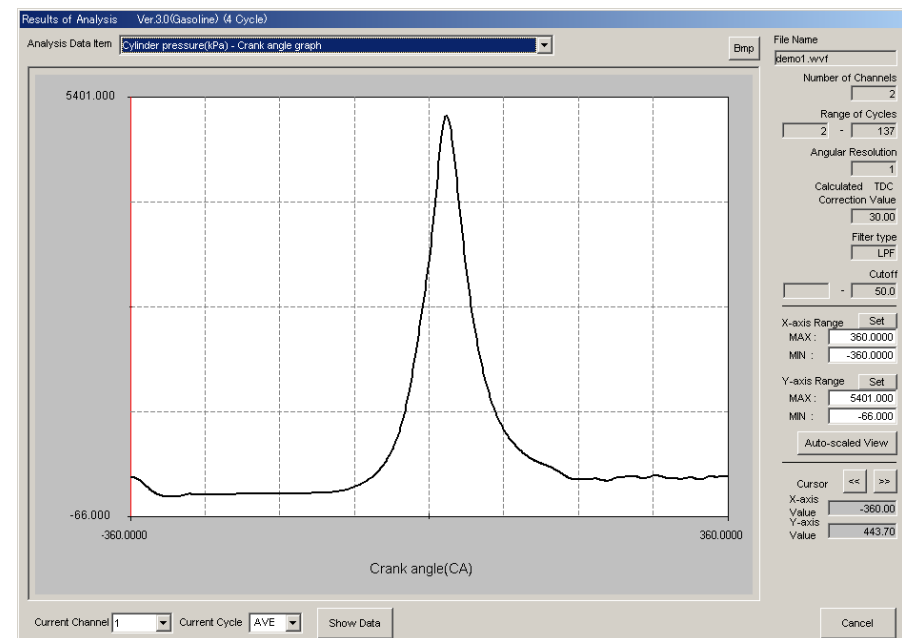
- **Maximum cylinder pressure and its crank angle**
- **Maximum rate of pressure rise and its crank angle**
- **IMEP**
- **PMEP**
- **NMEP**
- **Maximum cylinder gas temperature and its crank angle**
- **Maximum rate of heat release and its crank angle**
- **Maximum amount of heat release and its crank angle**
- **Angle at Combustion mass rate at N%**
- **Start point of combustion**
- **End point of combustion**



Crank Angle Graph in Off – Line Analysis



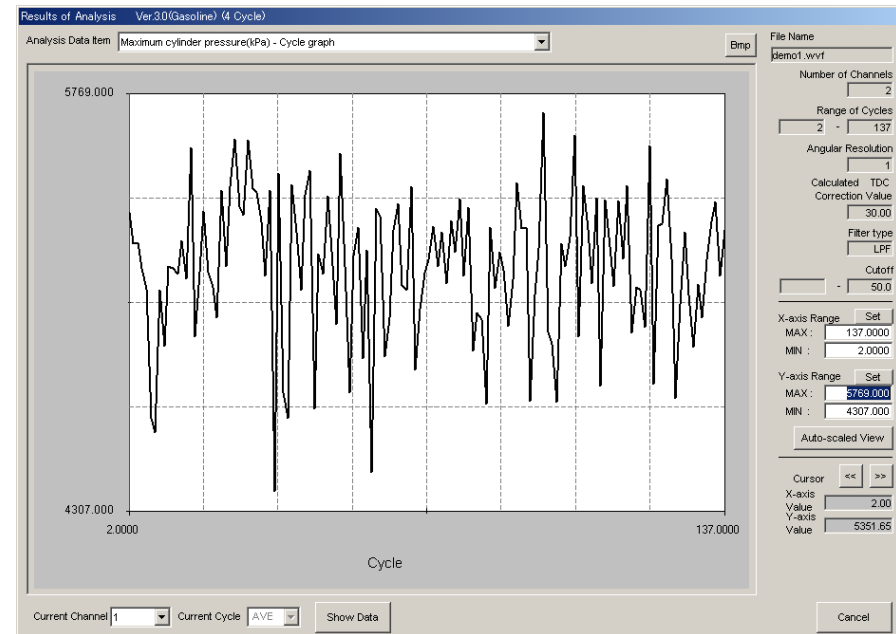
- Cylinder pressure - Crank angle graph
- Rate of cylinder pressure rise - Crank angle graph
- Amount of heat release - Crank angle graph
- Rate of heat release - Crank angle graph
- Combustion mass rate - Crank angle graph
- Cylinder gas temperature - Crank angle graph
- Cylinder pressure - Piston displacement graph
- Logarithmic cylinder pressure
 - - Logarithmic piston displacement graph
- Polytrophic index - Crank angle graph
- Ratio of specific heat - Crank angle graph
- Other signals - Crank angle graph



Cycle Graph in Off – Line Analysis



- **Maximum cylinder pressure - Cycle graph**
- **Angle at maximum cylinder pressure - Cycle graph**
- **Maximum rate of pressure rise - Cycle graph**
- **Angle at maximum rate of cylinder pressure rise - Cycle graph**
- **IMEP - Cycle graph**
- **PMEP - Cycle graph**
- **NMEP - Cycle graph**
- **Maximum cylinder gas temperature - Cycle graph**
- **Angle at Maximum cylinder temperature - Cycle graph**
- **Maximum amount of heat release - Cycle graph**
- **Angle at maximum amount of heat release - Cycle graph**
- **Maximum rate of heat release - Cycle graph**
- **Angle at maximum rate of heat release - Cycle graph**
- **Angle at Combustion mass rate at N% - Cycle graph**
- **Other signals - Cycle graph**



Numeric Analysis Data Items in Off – Line Analysis



- The average value, standard deviation and rate of change of the following items are available.
 - Maximum cylinder pressure
 - Maximum rate of pressure rise
 - IMEP
 - PMEP
 - NMEP
 - Maximum cylinder gas temperature
 - Maximum rate of heat release
 - Maximum amount of heat release
 - Angle at Combustion mass rate N%
- Average start point of combustion
- Average end point of combustion

| Analysis Data Item | Value | Unit |
|--|--------------|-----------|
| Averaged maximum cylinder pressure | 5.15951E+03 | [kPa] |
| Standard deviation of maximum cylinder pressure | 2.54894E+02 | [kPa] |
| Rate of change in maximum cylinder pressure | 4.94028E+00 | [%] |
| Averaged maximum rate of cylinder pressure rise | 1.27266E+02 | [kPa/deg] |
| Standard deviation of maximum rate of cylinder pressure rise | 2.03892E+01 | [kPa/deg] |
| Rate of change in maximum rate of cylinder pressure rise | 1.60209E+01 | [%] |
| Piston displacement | 1.00735E-03 | [m3] |
| Averaged NMEP | 1.05880E+03 | [kPa] |
| Standard deviation of NMEP | 2.07834E+01 | [kPa] |
| Rate of change in NMEP | 1.96291E+00 | [%] |
| Averaged IMEP | 1.27295E+03 | [kPa] |
| Standard deviation of IMEP | 1.97864E+01 | [kPa] |
| Rate of change in IMEP | 1.55437E+00 | [%] |
| Averaged PMEP | -2.14148E+02 | [kPa] |
| Standard deviation of PMEP | 1.49998E+00 | [kPa] |
| Rate of change in PMEP | -7.00449E-01 | [%] |

Converting the Analysis Data to CSV file



1. Engine and Other Parameters for Setup

2. Numeric analysis data items

3. Averaged crank angle graph data

Cylinder pressure / Logarithmic Cylinder pressure / piston displacement
Rate of cylinder pressure rise / Amount of heat release / Rate of heat release
Combustion mass rate / Cylinder gas temperature / Polytropic index
Other signals / Measurement data

4. Cycle graph data

Maximum cylinder pressure / Angle at maximum cylinder pressure
Maximum rate of pressure rise / Angle at maximum rate of cylinder pressure rise
Compression/expansion work / Pumping loss / IMEP / PMEP / NMEP
Maximum cylinder gas temperature / Angle at Maximum cylinder gas temperature
Maximum amount of heat release / Angle at maximum amount of heat release
Maximum rate of heat release / Angle at maximum rate of heat release
Angle at Combustion mass rate N%
Start point of combustion / End point of combustion
Other signals / Measurement data

5. Every crank angle graph data of each Cycle(xxx-all.csv)

Cylinder pressure / Rate of cylinder pressure rise
Amount of heat release / Rate of heat release
Combustion mass rate / Cylinder gas temperature
Other signals / Measurement data



Engine and Other Parameters for Setup in CSV file



| | | |
|--|---|-----------|
| <Manually Input Data Items> | | |
| Calculated TDC correction value (CA) | | 4.82E+01 |
| Number of cylinders | | 1 |
| Channel-by-channel TDC correction value (CA) | | 4.80E+01 |
| Channel-by-channel calibration factor A | | 1.00E+03 |
| Channel-by-channel calibration factor B | | 0.00E+00 |
| Channel-by-channel not available (1:Yes) | | 0 |
| Starting angle of correction interval (CA) | | -1.80E+02 |
| Ending angle of correction interval (CA) | | -1.79E+02 |
| Channel name | P1 | |
| Atmospheric pressure (kPa) | | 1.02E+02 |
| Stroke (m) | | 1.06E-01 |
| Con-rod length (m) | | 1.80E-01 |
| Piston offset (m) | | 0.00E+00 |
| Bore (m) | | 1.10E-01 |
| Clearance volume (m ³) | | 6.30E-05 |
| Fuel consumption (m ³ /sec) | | 1.00E-06 |
| Specific gravity | | 8.00E-01 |
| Revolutions per minute (rpm) | | 1.20E+03 |
| Suction volumetric efficiency (%) | | 8.00E+01 |
| Atmospheric temperature (degC) | | 3.14E+01 |
| Gas constant | | 2.93E+01 |
| Ratio of specific heat | | 1.32E+00 |
| Compression ratio | | |
| Boost pressure (kPa) | | 0.00E+00 |
| Ratio for judging angle of combustion mass rate N ^o | | 5.00E+01 |
| Number of cylinders | | 1.00E+00 |
| Method of absolute pressure correction | Absolute pressure correction for each cyl | |
| Number of data items for judging start point of com | | 3 |
| Number of data items for judging end point of com | | 3 |



Numeric Analysis Data Items in CSV File



| | |
|--|-----------|
| <Calculation Data Items:Numeric Data Items> | |
| Averaged maximum cylinder pressure (kPa) | 5.03E+03 |
| Standard deviation of maximum cylinder pressure (kPa) | 2.55E+02 |
| Rate of change in maximum cylinder pressure (%) | 5.08E+00 |
| Averaged maximum rate of cylinder pressure rise (kPa/deg) | 1.28E+02 |
| Standard deviation of maximum rate of cylinder pressure rise (kPa/deg) | 2.04E+01 |
| Rate of change in maximum rate of cylinder pressure rise (%) | 1.60E+01 |
| Piston displacement(m ³) | 1.01E-03 |
| Averaged NM EP (kPa) | 1.10E+02 |
| Standard deviation of NM EP (kPa) | 1.50E+01 |
| Rate of change in NM EP (%) | 1.36E+01 |
| Averaged MEP (kPa) | 3.31E+02 |
| Standard deviation of MEP (kPa) | 1.52E+01 |
| Rate of change in MEP (%) | 4.59E+00 |
| Averaged PM EP (kPa) | -2.21E+02 |
| Standard deviation of PM EP (kPa) | 1.19E+00 |
| Rate of change in PM EP (%) | -5.42E-01 |
| Averaged maximum cylinder gas temperature (degC) | 1.22E+03 |
| Standard deviation of maximum cylinder gas temperature (degC) | 2.31E+01 |
| Rate of change in maximum cylinder gas temperature (%) | 1.89E+00 |
| Averaged maximum rate of heat release (J/deg) | 2.48E+01 |
| Standard deviation of maximum rate of heat release (J/deg) | 1.76E+00 |
| Rate of change in maximum rate of heat release (%) | 7.09E+00 |
| Averaged maximum amount of heat release (J) | 1.30E+03 |
| Standard deviation of maximum amount of heat release (J) | 3.01E+02 |
| Rate of change in maximum amount of heat release (%) | 2.33E+01 |
| Averaged angle at combustion mass rate N% (CA) | 4.67E+01 |
| Standard deviation of angle at combustion mass rate N% (CA) | 4.17E+01 |
| Rate of change in angle at combustion mass rate N% (%) | 8.94E+01 |
| Average start point of combustion (point a) (CA) | 1.02E+01 |
| Average end point of combustion (point b) (CA) | 1.28E+02 |



Averaged Crank Angle and Cycle Graph In CSV File



| <Calculation Data Item s:720-CA Data Item s ICH | | ICH | ICH | ICH | ICH |
|---|---------------------------|---------------------|------------------------|------------------------|-----------------------------------|
| Angle | Average cylinder pressure | Logarithmic average | Piston displacement(m) | Rate of cylinder volum | Cylinder volume (m ³) |
| Averaged Crank Angle Data | -360 | 1.90E+02 | 2.28E+00 | 2.67E-07 | 6.30E-05 |
| | -359 | 1.80E+02 | 2.26E+00 | 1.41E-05 | 6.31E-05 |
| | -358 | 1.71E+02 | 2.23E+00 | 4.87E-05 | 6.34E-05 |
| | -357 | 1.62E+02 | 2.21E+00 | 1.04E-04 | 6.40E-05 |
| | -356 | 1.53E+02 | 2.18E+00 | 1.81E-04 | 6.47E-05 |
| | -355 | 1.45E+02 | 2.16E+00 | 2.78E-04 | 6.56E-05 |
| | -354 | 1.37E+02 | 2.14E+00 | 3.96E-04 | 6.67E-05 |
| | -353 | 1.29E+02 | 2.11E+00 | 5.35E-04 | 6.80E-05 |
| | -352 | 1.22E+02 | 2.09E+00 | 6.94E-04 | 6.96E-05 |
| | -351 | 1.15E+02 | 2.06E+00 | 8.74E-04 | 7.13E-05 |
| | -350 | 1.09E+02 | 2.04E+00 | 1.07E-03 | 7.32E-05 |
| | -349 | 1.03E+02 | 2.01E+00 | 1.29E-03 | 7.53E-05 |

| <Calculation Data Item s:Cycle Data Item s> | | ICH | ICH | ICH | ICH | ICH |
|---|---------------------------|------------------|-------------------------|-------------------------|----------------------|----------|
| Cycle | Maximum cylinder pressure | Crank angle at m | Maximum rate of cylinde | Crank angle at m axim u | Com pression/expans: | |
| Cycle Data | 1 | 4.89E+03 | 1.00E+00 | 1.14E+02 | -1.00E+01 | 3.56E+02 |
| | 2 | 5.23E+03 | 0.00E+00 | 1.45E+02 | -1.10E+01 | 3.41E+02 |
| | 3 | 5.11E+03 | 0.00E+00 | 1.31E+02 | -9.00E+00 | 3.36E+02 |
| | 4 | 5.12E+03 | 0.00E+00 | 1.33E+02 | -9.00E+00 | 3.36E+02 |
| | 5 | 5.03E+03 | 1.00E+00 | 1.30E+02 | -1.10E+01 | 3.47E+02 |
| | 6 | 4.95E+03 | 0.00E+00 | 1.26E+02 | -1.00E+01 | 3.57E+02 |
| | 7 | 4.50E+03 | 2.00E+00 | 8.91E+01 | -8.00E+00 | 3.55E+02 |
| | 8 | 4.45E+03 | 3.00E+00 | 8.08E+01 | -6.00E+00 | 3.71E+02 |
| | 9 | 4.95E+03 | 3.00E+00 | 1.09E+02 | -7.00E+00 | 3.64E+02 |
| | 10 | 4.75E+03 | 1.00E+00 | 1.12E+02 | -8.00E+00 | 3.50E+02 |
| | 11 | 5.03E+03 | 0.00E+00 | 1.24E+02 | -9.00E+00 | 3.45E+02 |
| | 12 | 5.02E+03 | 0.00E+00 | 1.33E+02 | -1.30E+01 | 3.46E+02 |
| | 13 | 5.02E+03 | 2.00E+00 | 1.10E+02 | -1.40E+01 | 3.49E+02 |
| | 14 | 5.12E+03 | 0.00E+00 | 1.43E+02 | -1.20E+01 | 3.22E+02 |
| | 15 | 4.99E+03 | 2.00E+00 | 1.14E+02 | -7.00E+00 | 3.58E+02 |
| | 16 | 5.45E+03 | 1.00E+00 | 1.46E+02 | -9.00E+00 | 3.47E+02 |
| | 17 | 4.80E+03 | 2.00E+00 | 1.07E+02 | -9.00E+00 | 3.64E+02 |
| | 18 | 5.01E+03 | 1.00E+00 | 1.25E+02 | -1.00E+01 | 3.42E+02 |
| | 19 | 5.23E+03 | 0.00E+00 | 1.45E+02 | -1.00E+01 | 3.31E+02 |
| | 20 | 5.02E+03 | 1.00E+00 | 1.31E+02 | -9.00E+00 | 3.56E+02 |
| | 21 | 4.96E+03 | 1.00E+00 | 1.31E+02 | -1.00E+01 | 3.37E+02 |



Every Crank Angle Graph Data of Each Cycle(xxx-all.csv) in CSV File



| <1 Cycle> 1CH Angle | 1CH Cylinder pressure (kPa) | 1CH Logarithmic cylinder pressure | 1CH Rate of cylinder pressure | 1CH Cylinder gas temperature | 1CH Rate of heat release | 1CH Amount of heat release | 1CH Combustion mass rate |
|------------------------|--------------------------------|--------------------------------------|----------------------------------|---------------------------------|-----------------------------|-------------------------------|-----------------------------|
| -360 | 1.96E+02 | 2.29E+00 | -4.08E+00 | -2.31E+02 | -7.78E-01 | 0.00E+00 | 0.00E+00 |
| -359 | 1.88E+02 | 2.27E+00 | -8.83E+00 | -2.33E+02 | -1.56E+00 | 0.00E+00 | 0.00E+00 |
| -358 | 1.81E+02 | 2.26E+00 | -6.88E+00 | -2.34E+02 | -1.04E+00 | 0.00E+00 | 0.00E+00 |
| -357 | 1.74E+02 | 2.24E+00 | -7.19E+00 | -2.35E+02 | -9.86E-01 | 0.00E+00 | 0.00E+00 |
| -356 | 1.67E+02 | 2.22E+00 | -7.96E+00 | -2.36E+02 | -1.04E+00 | 0.00E+00 | 0.00E+00 |
| -355 | 1.58E+02 | 2.20E+00 | -8.06E+00 | -2.38E+02 | -9.84E-01 | 0.00E+00 | 0.00E+00 |
| -354 | 1.51E+02 | 2.18E+00 | -7.65E+00 | -2.39E+02 | -8.36E-01 | 0.00E+00 | 0.00E+00 |
| -353 | 1.43E+02 | 2.16E+00 | -8.17E+00 | -2.40E+02 | -9.01E-01 | 0.00E+00 | 0.00E+00 |
| -352 | 1.34E+02 | 2.13E+00 | -8.33E+00 | -2.41E+02 | -9.17E-01 | 0.00E+00 | 0.00E+00 |
| -351 | 1.26E+02 | 2.10E+00 | -7.88E+00 | -2.42E+02 | -8.11E-01 | 0.00E+00 | 0.00E+00 |
| -350 | 1.19E+02 | 2.07E+00 | -7.52E+00 | -2.43E+02 | -7.40E-01 | 0.00E+00 | 0.00E+00 |
| -349 | 1.11E+02 | 2.05E+00 | -7.00E+00 | -2.44E+02 | -6.38E-01 | 0.00E+00 | 0.00E+00 |
| -348 | 1.05E+02 | 2.02E+00 | -6.60E+00 | -2.45E+02 | -5.70E-01 | 0.00E+00 | 0.00E+00 |
| -347 | 9.85E+01 | 1.99E+00 | -5.27E+00 | -2.46E+02 | -2.72E-01 | 0.00E+00 | 0.00E+00 |
| -346 | 9.40E+01 | 1.97E+00 | -4.90E+00 | -2.47E+02 | -1.93E-01 | 0.00E+00 | 0.00E+00 |
| -345 | 8.87E+01 | 1.95E+00 | -4.29E+00 | -2.47E+02 | -6.65E-02 | 0.00E+00 | 0.00E+00 |
| -344 | 8.55E+01 | 1.93E+00 | -3.25E+00 | -2.47E+02 | 2.07E-01 | 0.00E+00 | 0.00E+00 |
| -343 | 8.20E+01 | 1.91E+00 | -3.31E+00 | -2.47E+02 | 1.74E-01 | 0.00E+00 | 0.00E+00 |
| -342 | 7.90E+01 | 1.90E+00 | -2.73E+00 | -2.47E+02 | 3.31E-01 | 0.00E+00 | 0.00E+00 |
| -341 | 7.65E+01 | 1.88E+00 | -2.38E+00 | -2.47E+02 | 4.31E-01 | 0.00E+00 | 0.00E+00 |
| -340 | 7.42E+01 | 1.87E+00 | -1.96E+00 | -2.47E+02 | 5.57E-01 | 0.00E+00 | 0.00E+00 |
| -339 | 7.25E+01 | 1.86E+00 | -1.85E+00 | -2.47E+02 | 5.93E-01 | 0.00E+00 | 0.00E+00 |
| -338 | 7.05E+01 | 1.85E+00 | -1.98E+00 | -2.46E+02 | 5.43E-01 | 0.00E+00 | 0.00E+00 |
| -337 | 6.87E+01 | 1.84E+00 | -1.17E+00 | -2.46E+02 | 8.28E-01 | 0.00E+00 | 0.00E+00 |
| -336 | 6.80E+01 | 1.83E+00 | -1.15E+00 | -2.45E+02 | 8.54E-01 | 0.00E+00 | 0.00E+00 |
| -335 | 6.65E+01 | 1.82E+00 | -9.17E-01 | -2.45E+02 | 9.44E-01 | 0.00E+00 | 0.00E+00 |
| -334 | 6.62E+01 | 1.82E+00 | -2.08E-01 | -2.44E+02 | 1.26E+00 | 0.00E+00 | 0.00E+00 |
| -333 | 6.57E+01 | 1.82E+00 | -1.06E+00 | -2.43E+02 | 9.30E-01 | 0.00E+00 | 0.00E+00 |
| -332 | 6.45E+01 | 1.81E+00 | -2.50E-01 | -2.42E+02 | 1.28E+00 | 0.00E+00 | 0.00E+00 |
| -331 | 6.52E+01 | 1.81E+00 | 4.38E-01 | -2.41E+02 | 1.65E+00 | 0.00E+00 | 0.00E+00 |
| -330 | 6.52E+01 | 1.81E+00 | 6.04E-01 | -2.40E+02 | 1.78E+00 | 0.00E+00 | 0.00E+00 |
| -329 | 6.65E+01 | 1.82E+00 | 1.10E+00 | -2.38E+02 | 2.10E+00 | 0.00E+00 | 0.00E+00 |
| -328 | 6.72E+01 | 1.83E+00 | 5.83E-01 | -2.36E+02 | 1.92E+00 | 0.00E+00 | 0.00E+00 |
| -327 | 6.80E+01 | 1.83E+00 | 1.60E+00 | -2.34E+02 | 2.52E+00 | 0.00E+00 | 0.00E+00 |
| -326 | 7.02E+01 | 1.85E+00 | 1.69E+00 | -2.31E+02 | 2.70E+00 | 0.00E+00 | 0.00E+00 |
| -325 | 7.12E+01 | 1.85E+00 | 1.31E+00 | -2.29E+02 | 2.59E+00 | 0.00E+00 | 0.00E+00 |
| -324 | 7.30E+01 | 1.86E+00 | 1.56E+00 | -2.27E+02 | 2.85E+00 | 0.00E+00 | 0.00E+00 |

