C1960
Circular chart recorder/controller

Multi-recipe profile recorder/controller

Measurement made easy

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**Electrical safety**

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

**Symbols**

One or more of the following symbols may appear on the equipment labelling:

- ![Triangle] (Warning) – refer to the manual for instructions
- ![Triangle] (Caution) – risk of electric shock
- ![Line] (Protective earth (ground) terminal)
- ![Line] (Earth (ground) terminal)
- ![Dash] (Direct current supply only)
- ![Dash] (Alternating current supply only)
- ![Dash] (Both direct and alternating current supply)
- ![Box] (The equipment is protected through double insulation)

**Health and safety**

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.
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INTRODUCTION

The COMMANDER 1960 is a development of the COMMANDER 1900 with enhanced and improved Ramp/Soak profiling making the COMMANDER 1960 more powerful and flexible to your needs.

The following pages explain some of the main features of the COMMANDER 1960 to give you an idea of their function and how they can be used.

COMMANDER 1960 Versions
There are two versions of the COMMANDER 1960 ('K' Retort and 'L' Advanced). Details of these and basic operations are listed below.

Selection
The two options ('K' Retort or 'L' Advanced) are selected in the instrument code under software versions and are activated by fitting the corresponding software key.

Applications
The two versions have been designed with specific applications in mind.

'K' Software
• For use in Food processing industries for food cooking and sterilising where simple Ramp/Soaks are used and changed often to suit the different products being processed.

'L' Software
• For use in the Tire and General process industries which use more complex Ramp/Soak profiles and have need to adjust the cook times during the process.

Advanced Profile Control Models
The COMMANDER 1960 Profile Controller is available in four versions:

1961R single pen, single loop ramp/soak control
1962R two pen, single loop ramp/soak control
1963R three pen, single loop ramp/soak control
1964R two pen, dual loop ramp/soak control

Each model is available with a choice of software providing additional specialized features.

K Type Retort Controller Models
• Front panel adjustment of principal soak temperature and soak time.
• Continuous display of principal soak temperature, soak time and current segment number.
• LED indication of whether ramp or soak is being performed.
• LED indication of profile status.
• 6 time-event states common to all segments.
• Guaranteed ramp/soak by segment.

L Type Advanced Profile Control Models
• Continuous display of level (soak segments) or target set point (ramping segments).
• Front panel adjustment of the current soak time.
• Continuous display of time remaining in current segment.
• Continuous display of current segment number.
• LED indication of whether ramp or soak is being performed.
• LED indication of profile status.
• 6 time-event states common to all segments.
• Guaranteed ramp/soak by segment.
DISPLAYS AND CONTROLS

Type K Instrument
Displays and LED Indicators

Controller Faceplate

LED Indicators
Displays (refer to IM/C1900–OGC, Section 3)

Bar Graph Display
Controls (refer to IM/C1900–OGC, Section 3 for functions)

Ramp/Soak Control Faceplate

LED Indicators
Soak level of cook segment
Time remaining in cook segment
Current segment
Status LEDs – show whether a ramp or a soak is being performed (Flashing under fault conditions)

Controls – Refer to Fig. 2.2 for functions

LED Indicators – show the current status of the profile i.e running, on hold or stopped

Controls and LEDs – Type K

Switch Functions – Type K

- RUN: Start the profile running
- HOLD: Hold (pause) the profile
- STOP: Stop and reset the profile
- ▲: Increment soak time/soak level
- ▼: Decrement soak time/soak level
- : Select between soak level and soak time adjustment

Type L Instrument
Displays and LED Indicators

Controller Faceplate

LED Indicators
Displays (refer to IM/C1900–OGC, Section 3)

Bar Graph Display
Controls (refer to IM/C1900–OGC, Section 3 for functions)

Ramp/Soak Control Faceplate

LED Indicators
Level or target setpoint of current segment (ie end of ramp/soak level)
Time remaining in current segment
Current segment
Status LEDs – show whether a ramp or a soak is being performed (Flashing under fault conditions)

Controls – Refer to Fig. 2.4 for functions

LED Indicators – show the current status of the profile i.e running, on hold or stopped

Controls and LEDs – Type L

Switch Functions – Type L

- RUN: Start the profile running
- HOLD: Hold (pause) the profile
- STOP: Stop and reset the profile
- ▲: Increment current segment soak time
- ▼: Decrement current segment soak time
- : Not used

Note. If the profile is stopped, the display shows a series of dashes.
Faceplate Combinations and Product Codes

**Model 1961R** derived from the C1911R single pen, single loop ramp/soak control

- Control Faceplate Channel 1
- Ramp/Soak Control Faceplate Channel 1

**Model 1962R** derived from the C1912R two pen, single loop ramp/soak control

- Control Faceplate Channel 1
- Record Faceplate Channel 2
- Ramp/Soak Control Faceplate Channel 1

**Model 1963R** derived from the C1913R three pen, single loop ramp/soak control

- Control Faceplate Channel 1
- Record Faceplate Channels 2 and 3
- Ramp/Soak Control Faceplate Channel 1

**Model 1964R** derived from the C1922R two pen, dual loop ramp/soak control

- Control Faceplate Channel 1
- Control Faceplate Channel 2
- Ramp/Soak Control Faceplate Channel 1

**Note.** On the C1964R both loops of control have enhanced guaranteed ramp soak software and advanced time event software but the additional Ramp/Soak Control faceplate applies only to channel 1.
Introduction to Ramp/Soak Profile Control

- 10 programs per control channel.
- Digital State program selection – allows digital inputs to select program to be run.
- 99 programmable segments – can be shared between programs and controllers – see Fig. 4.2.
- Programmable time units – can be programmed in hours or minutes.
- Program repeat – 0 to 99 times or continuously.
- Program holdback hysteresis – separate settings for ramping segments and soak segments.
  - can be applied above, below or above and below the set point.
- 6 types of ramp/soak generated events – segment active event, program active event, end of program event, holdback event, hold active event and time events.
- 6 ramp/soak commands – can be selected from the front panel or via digital signals to run/hold programs, reset programs, skip forward to next segment, skip backwards to beginning of segment, increase soak time or decrease soak time (refer to relevant figs for ramp/soak adjust example).
- 6 time event states – common to each segment
- Self-seeking set point function – avoids unnecessary delays when a program is started – see Fig. 4.4.
- Retort function – ensures safe operation under fault conditions.
- Power recovery function – determines ramp/soak profile restart position.
- End of Profile State – latched ‘ON’ until reset

The Ramp/Soak option is a set point profile generator which controls the Local set point and can be used with any type of control process for more complex control. A Profile Program is made up of Ramps (the set point is increased or decreased at a linear rate until it reaches the desired value) and Soaks (the set point is maintained at a fixed value for a set time duration).

Program Configurations

There are 99 segments that can be shared between programs and control channels. For normal applications it is recommended that segments 1 to 50 are assigned to channel 1 and segments 51 to 99 are assigned to channel 2. The figure below shows 9 segments, shared between four separate programs on channel 1 and channel 2.
Guaranteed Ramp/Soak

If the process variable deviates from the set point by more than the hysteresis value, the program status is set to 'H-HOLD' and Guaranteed ramp/soak is applied automatically. Each program has two associated hysteresis values;

- **HYSt-$r$** which is applied to ramping segments, and
- **HYSt-$s$** which is applied to soak segments.

The hysteresis value can be set within the limits ‘0’ to ‘9999’ where a setting of ‘0’ implies that no deviation from the set point value can be tolerated (‘0’ is the company standard setting).

Hysteresis can be applied in one of four ways, with individual settings for each segment;

- **OFF** – hysteresis not applied, ramp/soak not guaranteed.
- **HI** – hysteresis applied above set point (Holdback ('H-HOLD') set if PV > [SP + Hysteresis]).
- **LO** – hysteresis applied below set point (‘H-HOLD’ set if PV < [SP – Hysteresis]).
- **HI-LO** – hysteresis applied above and below set point ('H-HOLD' set if PV > [SP + Hysteresis] or PV < [SP – Hysteresis]).

**Note.** Ramping segments can have a different hysteresis to soak segments.

**Typical 6-segment Ramp/Soak Profile**
Self-seeking Set Point
The Self-seeking Set Point function reduces the delay between the end of a program and the beginning of the next program. The process variable value is used as the program start point and the set point steps up to the process variable value. This has the effect of changing the overall segment time and maintains a constant ramp rate.

Retort Function
The Retort function ensures safe operation of retort vessels under fault conditions. If the heat source fails during a soak segment, the process variable will inevitably fall. When the process variable falls below the holdback hysteresis value the program is put on HOLD (as for normal operation). The setpoint then follows the process variable as it continues to fall (Retort Hold).

Setpoint = Process Variable + Hysteresis value

Upon recovery of the heat source, the process is controlled at the new setpoint value. When the process variable reaches the setpoint it is then ramped back to the initial soak value at the rate of the previous ramp (Retort Ramp). When the soak level is reached the program is released from its hold state and the segment is either completed or repeated from the beginning, depending on the retort mode selected.

The retort mode is selected in the Ramp/Soak Profile Page, CONTROL CONFIGURATION LEVEL.

Note. For the retort function to operate, either LO or HI-LO hysteresis must be applied to the soak segments.
Power Recovery Function
The Power Recovery function allows pre-selection of the restart position within a ramp/soak profile when power is restored after a failure. If power is restored before the Power Down Time expires, the ramp/soak profile continues from the point at which power failed. If power is restored after the Power Down Time has expired, the profile resumes from one of the following user-selected points: start of the current program; start of the current segment or from the profile position at the time of failure. In all three cases the controller restarts in HOLD mode.

Time Events
Channel 1 and 2 can be assigned up to six Time-event states. Each state generates a source (‘t EV-1.1’ to ‘t EV-6.1’ and ‘t EV-1.2’ to ‘t EV-6.2’) which can be assigned to relays, digital outputs, logic equations etc. in the same way as any other digital signal.
Time event states are provided in addition to program and segment events states and do not affect their operation. Each segment has an associated ‘t EV’ setting which is used to control the Time-event states.

End of Profile State
The end of profile state is a digital source which can be assigned in the same manner as any other digital signal. The state is set automatically when the program is complete and remains set until a reset signal is received. The state can be configured to reset via a digital source – or alternatively, if set to ‘NONE’, the state resets automatically after two seconds.

Soak Adjustment – Type K Instruments
Cook Segment Soak Adjustment (Control Channel 1 only)
The cook segment is defined as the soak segment with the highest soak level or the last segment in a series if more than one segment has this level (ie. the highest segment number).

The level and/or duration of the cook segment can be adjusted continuously, either by use of the keys on the Ramp/Soak control faceplate, or via digital signals – see Ramp/Soak Profile Control Page. The adjustment can be activated at any time during the program.
...Soak Adjustment – Type K Instruments

...Cook Segment Soak Adjustment (Control Channel 1 only)
The Ramp/Soak control faceplate displays the time remaining in the cook segment. Initially, this is the segment duration, and it decrements to zero as the segment is being run. After the cook segment is completed, the display remains at zero until the end of the program, when it reverts back to the show segment duration. If several segments with the same soak level are cascaded, the time displayed is the total time for all these segments. Adjustments made to the soak level change the level of all these segments. Adjustments made to the soak time change the duration of the last segment only.

**Note.** Any changes made to the cook time/temperature are saved in the program memory.

---

Current Segment Soak Time Adjustment (Control Channels 1 or 2)
The Soak Adjust function allows the Soak time of a segment to be extended or reduced by a value preset in the ‘SK–Adj’ frame – see Ramp/Soak Profile Control Page. The soak time can be adjusted repeatedly (in preset increments) while the segment is running, either from the controller faceplate or by a digital signal (assigned in the ‘Inc.Src’ or ‘dEc.Src’ frames).

**Note.** Any changes made to the soak time via the controller faceplate are not saved in the program memory. At the end of the program, all soak times are reset to their original values.
...Soak Adjustment – L Type Instruments

Current Segment Soak Time Adjustment
The Soak Adjust function allows the Soak time of a segment to be extended or reduced by a value preset in the ‘SK–Adj’ frame – see Ramp/Soak Profile Control Page. The soak time can be adjusted repeatedly (in preset increments) while the segment is running, either from the Ramp/Soak control faceplate, the Controller faceplate or by a digital signal (assigned in the 'Inc.Src' or 'dEc.Src' frames).

Note. At the end of the program, all soak times are reset to their original values.

Fig 4.9 Current Segment Soak Adjustment – Controller 1 Ramp/Soak Control Faceplate

Fig 4.10 Current Segment Soak Adjustment – Controller 1 or 2 Faceplates