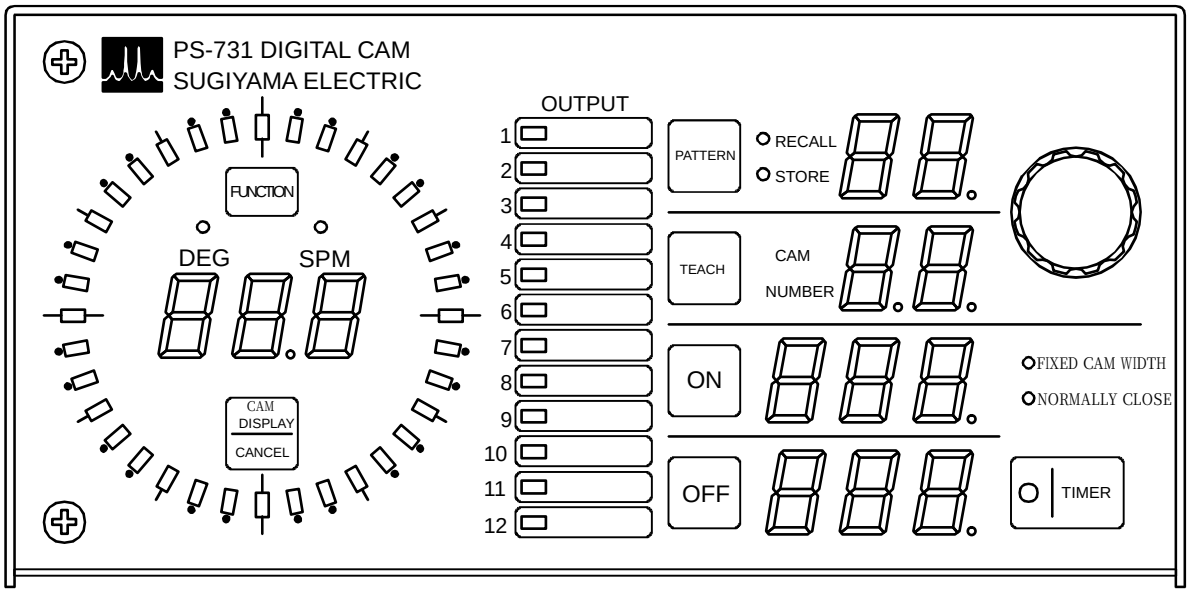
DIGITAL/ CAM

PS－731

INSTRUCTION MANUAL

Program Version 1.2x



SUGIYAMA ELECTRIC SYSTEM INC.

Revisions from V.1 1x (April, 2001)
The TIMER button operations are revised when switching the ANGLE control to the TIMER control or vice versa.
Holding down the TIMER button for 2 seconds are required to switch them.

Warning

Use the voltage of the power source with AC100-240V.
The voltage exceeding a specified voltage may cause fire.

Do not touch the terminal block.
Electric shock may occur when coming into contact with a metal part of the terminal block.

Do not disassemble, repair or modify the digital cam. Disassemling, repairing, or modifying is very dangerous.
In breaking down, turn the power source off immediately and stop the use.

In the case of abnormal conditions such as heat, smoke and strange smell, turn the power source off immediately and stop the use.
The continuous use may cause fire or electric shock.

Caution

Make sure that this digital cam is firmly secured.
The digital cam may drop if used under unsteady conditions, which may result in an injury.

Do not use the device exposed to water or other liquids.
Otherwise it may cause a malfunction, fire, or electric shock.

Check before use.
After turning the power source on, check that each function operates normally.

Contents

1. Description

Digital Cam PS-731 is designed to compare setting values on the panel with signals from the rotary encoder installed in the rotating shaft of the press machine and output control signals equal to the rotary cam.
PS-731 has many features that have never been seen before. Due to the installation of high performance microcomputer and large capacity memory in PS-731, its operability has been improved; especially the enhanced display functions make it easier for you to check the settings and operations.

1-1. Features

○ Sufficient cam channels

Conventional devices are sometimes short of the channel number. In PS-731, the channel number is increased to 12 channels. You can also have 8 or less of SSRs built-in to PS-731.

○ Pulser for number setting

Pulser (manual rotary encoder) is employed in PS-731 for number setting. Combination use of pulser and microcomputer eliminates out of the setting range and improves PS-731's operability.

○ Angle setting by fixed cam width setting

In the cam channel with the fixed cam width setting, you can make the angle setting while changing both control angle ON and control angle OFF simultaneously. This will be able to eliminate the reverse setting of ON/OFF angle and reduce setting errors.

○ Roulette angle display

In addition to the number display to show the present angle of the rotary encoder, PS-731 has the roulette angle display. Control angle setting value can be confirmed in roulette angle display, which makes your visual check more easily.

○ Flexible choice of device setting

Automatic advance angle system or timer operations are set for all channels.

○ Pattern storing

Settings can be stored or recalled as a pattern. You can change settings when replacing dies by specifying a pattern number. Pattern numbers ranges from 0 to 99.

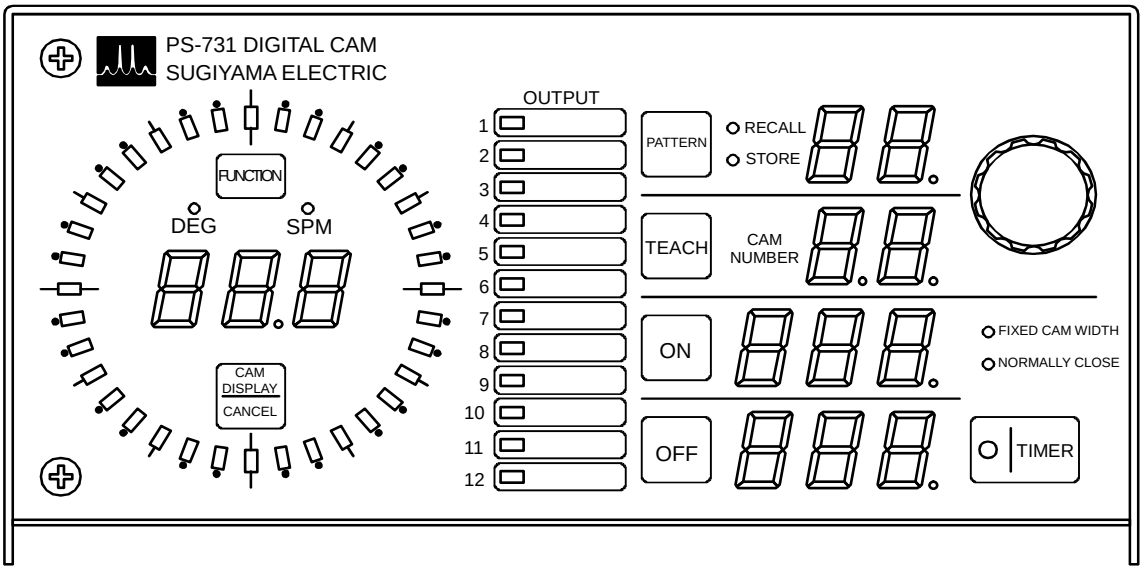
○ Device setting

PS-731 operations can be partially altered by device settings.

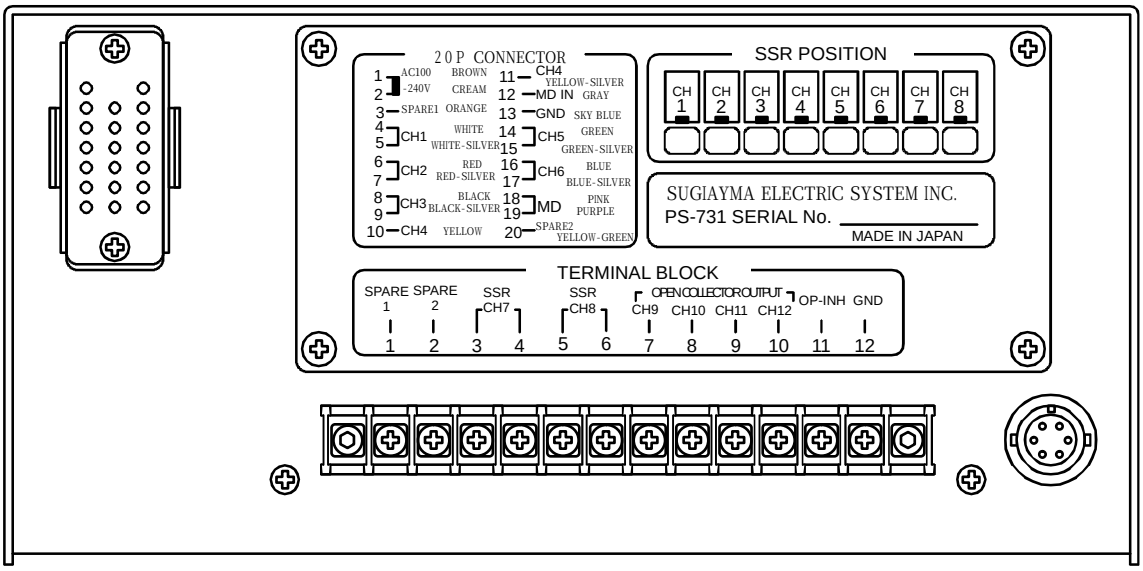
○ Compatible output connector

PS-731's output connector is compatible with our conventional device, PS-701. It is easy to replace PS-701 with PS-731.

2. Description of panel



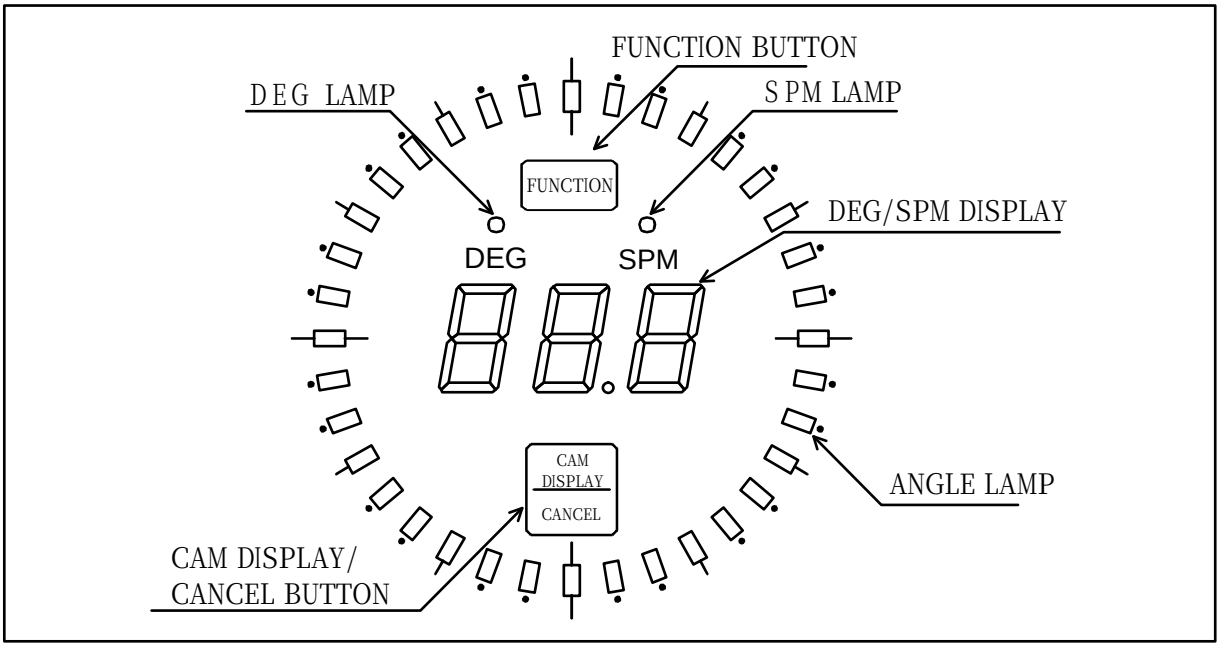
Front panel



Back panel

2-1. DEG/SPM display

Such displays as roulette angle display and number display are on the DEG/SPM display.



2-1-1. DEG/SPM display

An angle or SPM is shown with 3-digit numerical number. When showing the angle display, DEG lamp lights up. When indicating the SPM, the SPM lamp lights up.

If any error is detected in the system, Exx (xx represents a 2-digit number) shows up and blinks on the display.

2-1-2. DEG, SPM lamps

These lamps represent whether the data shown is an angle or SPM; the DEG lamp shows an angle, while the SPM lamp indicates the number of SPM.

2-1-3. Roulette angle display lamp

The angle is indicated in steps of 10°, with using 36 lamps. A lighting lamp indicates the angle, ranging -4 to +5°.

When pushing the CAM DISPLAY button, lamps from ON angle to OFF angle light up. You can confirm the angle position of the cam number you presently select. When the timer operation is selected in the cam setting, 1 lamp corresponding to the ON angle lights up.

2-1-4. CAM DISPLAY/CANCEL button

Push the CAM DISPLAY/CANCEL button to show cam condition on the roulette angle display or cancel it. The button is also used to interrupt numeric value settings or release an error.

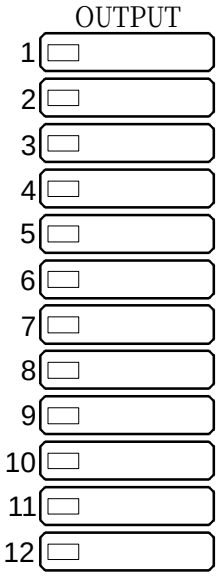
2-1-5. FUNCTION button

Push the button to decide the pattern number you select when recalling or storing pattern. If you push the FUNCTION button while holding down the CAM DISPLAY/CANCEL button, device settings will be available.

2-2. OUTPUT lamps

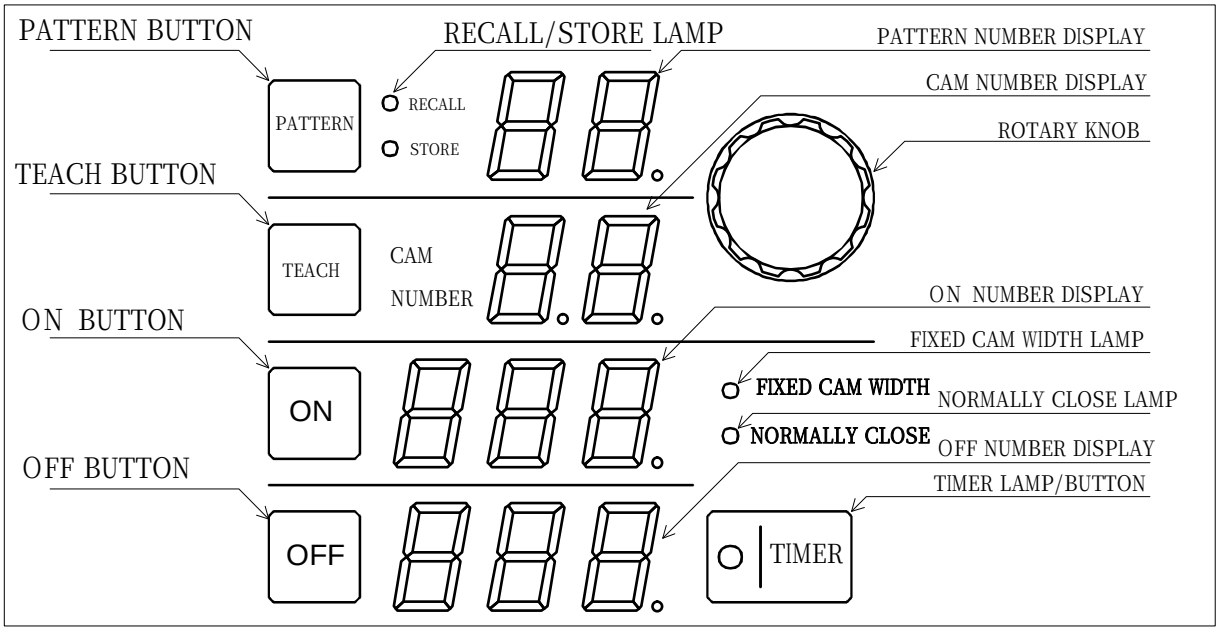
Each cam's output condition is indicated. If the OUTPUT lamp lights up, output is ON when the NORMALLY CLOSE lamp is off; output is OFF when the lamp is on.

You can put a sticker to specify the usage on the right of the space.



2-3. Pattern/cam setting area

Pattern operational and cam setting areas are shown below on the panel.



2-3-1. Rotary knob

The rotary knob is used for setting numeric values. Turn the knob clockwise to increase the number and counter-clockwise to decrease. Rotating speed increases or decreases setting values. If slowly, the number increases/decreases by 1; if quickly, it increases/decreases by 5.

2-3-2. Pattern button

Push the PATTERN button to store or recall the setting pattern.

2-3-3. RECALL, STORE lamps

These buttons indicate what state the pattern is presently in. The RECALL lamp lights in recalling; the STORE lamp lights in storing. No pattern operations are allowed when both lamps are off.

2-3-4. Pattern number display

The pattern number presently in use is displayed. You can change pattern numbers by rotating the rotary knob during pattern operations. If a decimal point is displayed, it represents that the setting in use is different with stored data.

2-3-5. Cam number display

Cam number ranges 1-12. You can change the cam number by turning the rotary knob when none of numeric number displays blinks. If you change the cam number, the setting angle shown on the display varies according to the cam number.

2-3-6. ON, OFF displays

An angle and time to be set are displayed. When the cam is during the angle control, the ON display shows the start angle; the OFF display indicates the end angle. During the timer control, the ON display shows the start angle; the OFF display represents the timing of the timer. As for the angle display of the cam for which the automatic advance timing has been set, advanced angle is shown during operations. In this time, a decimal digit lights up. When changing the setting, the display blinks.

2-3-7. TEACH button

When changing the setting angle, push the TEACH button to decide the angle shown on the display as a setting angle.

2-3-8. ON button

Push the ON button to start/end the ON setting angle or ON automatic advance angle timing.

2-3-9. OFF button

Push the OFF button to start/end the OFF setting angle, OFF automatic advance timing, and timer timing.

2-3-10. NORMALLY CLOSE lamp

The lamp indicates the output polarity of the cam specified by the cam number. The output is turned off either when both NORMALLY CLOSE lamp and CAM OUTPUT lamp light up or both of them are off. The output polarity is adjusted by the device setting.

2-3-11. FIXED WIDTH CAM lamp

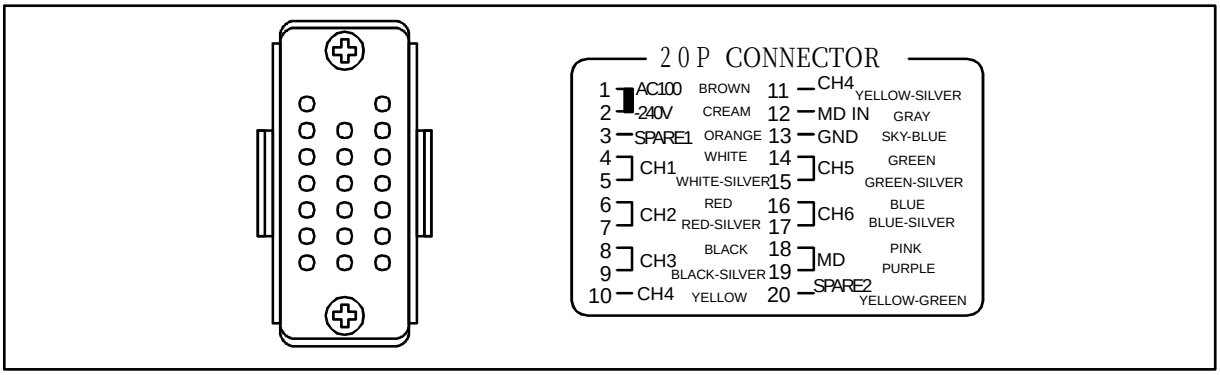
When the FIXED CAM WIDTH lamp is off, the angle is set for ON or OFF individually. When it is on, you can change the setting without changing the angle width only by setting either ON or OFF. The FIXED CAM WIDTH is set by the device setting.

2-3-12. TIMER button/lamp

Push the TIMER button for 2 seconds to switch the TIMER lamp on or off. When the TIMER lamp is off, the output is in angle control: when it is on, it is in timer mode. The OFF display shows the angle in the angle control or time in the timer mode.

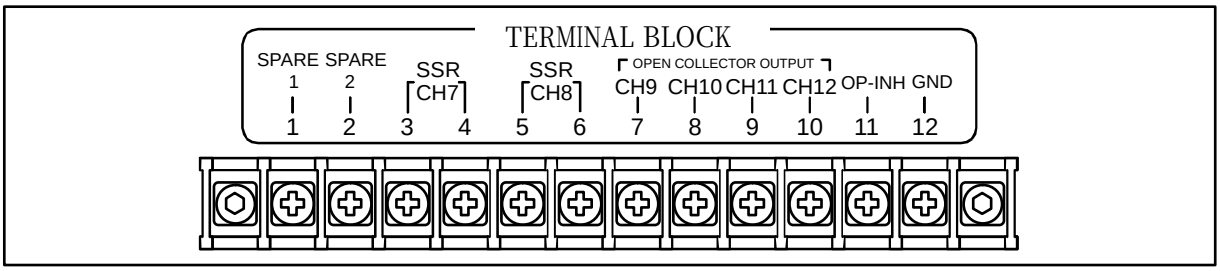
2-4. Output connector

Output connector is 20-polarity. Use a special cable attached with a connector. The connector has such terminals as SSR output, MD input/output, power supplies.



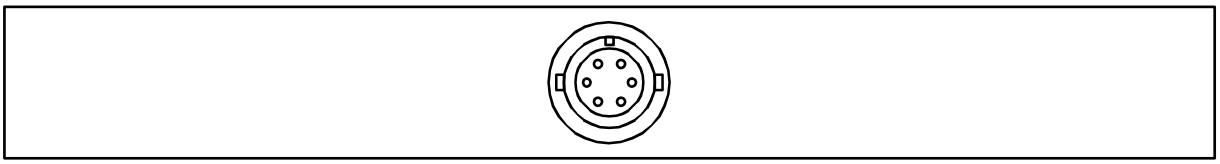
2-5. Terminal block

The terminal block has 12-polarity. Such terminals as SSR outputs of CH7 and CH8, open collector outputs, operation inhibition input are on the terminal block.



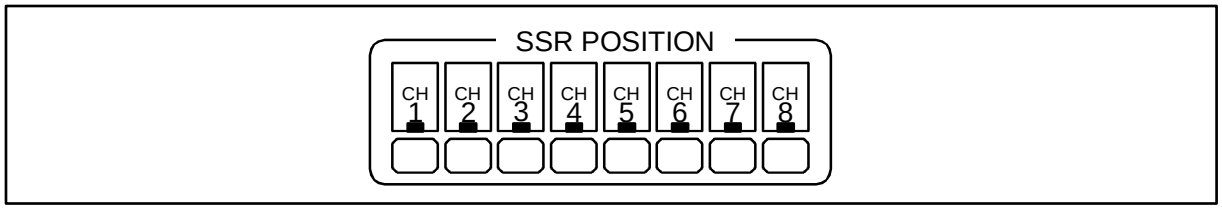
2-6. Encoder connector

The encoder connector has 6-polority to connect to the rotary encoder.



2-7. SSR for output

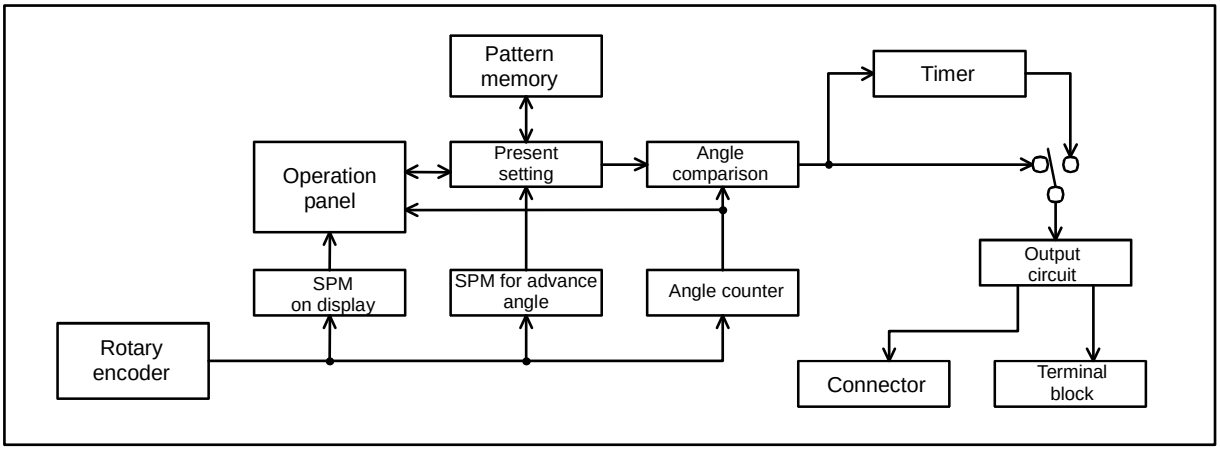
Remove the back plate to add/replace SSRs for output. You can have 8 SSRs for CH1-8 built in.



3. Function

3-1. Schematic diagram of PS-731's operation

PS-731 operates as follows; output through output circuits, comparing the setting control angle with the angle converted from revolution signals from rotary encoder installed to the press machine.



Schematic diagram of PS-731's operation

The revolution signal from the rotary encoder is converted to an angle of 0-359° in the angle counter. Values in the angle counter are displayed in the operational panel and used as an angle comparison value.

The SPM on display is calculated from zero phase signal of the rotary encoder, and the SPM for advance angle is from the revolution time for the angle width you specified.

In the present setting, control angles for 12 channels can be set. Comparing the control angles with the value of the angle counter, an output signal is generated. If the SPM for advance angle is calculated when the automatic advance timing is set for the control angle in the present setting, the control angle changes temporarily and the output signal will be for an advance angle output.

The output signal is also connected to the timer. An output signal can be taken, converting the angle control output to the timer control output.

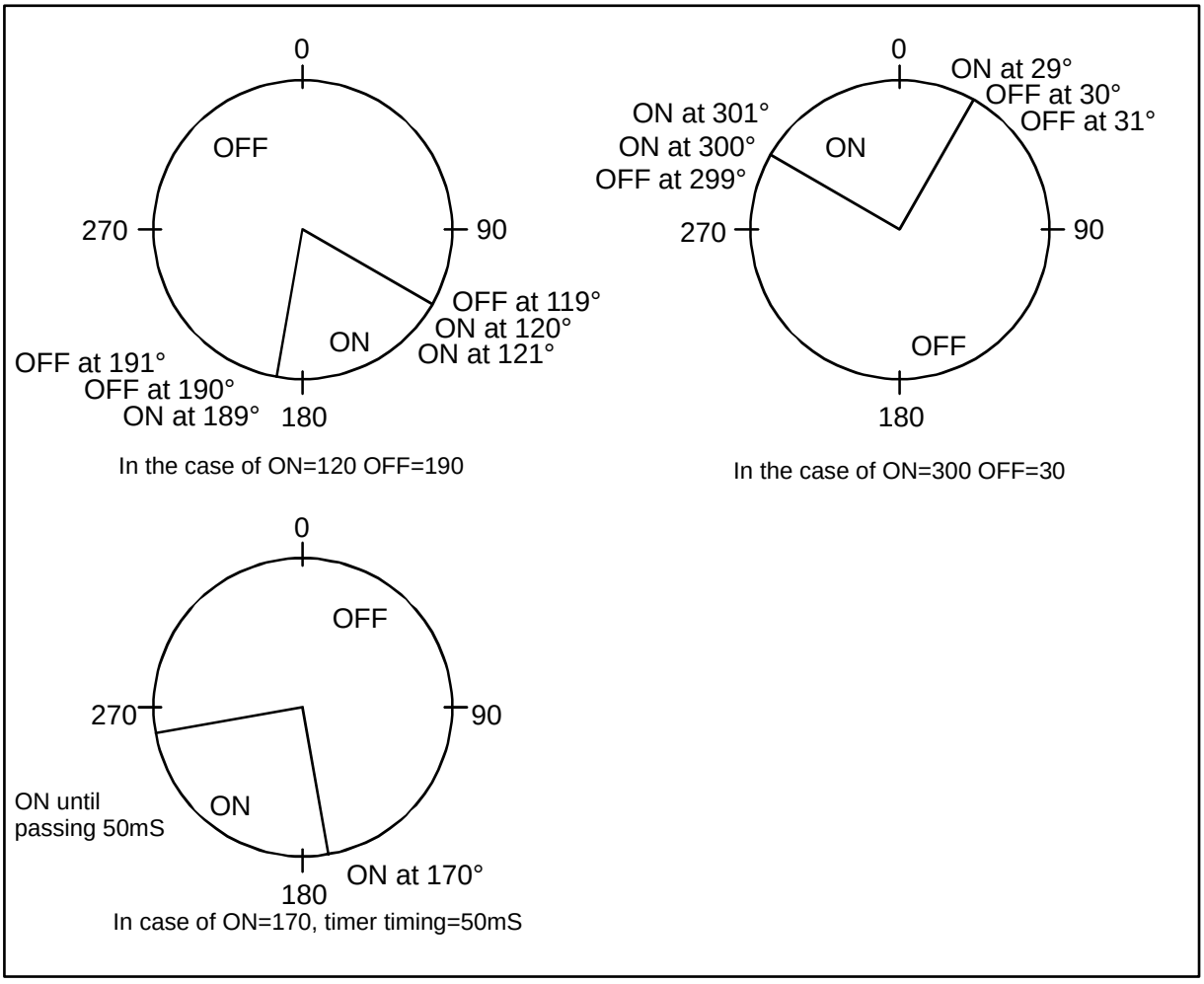
Pattern memory is used to store control angles in the present setting. 100 patterns or less can be stored, as 1 pattern for setting of 12 channels. Unless the values stored in the pattern memory are recalled to the present setting, neither use nor alternation is allowed.

8 or less AC or DCSSR can be implemented in the output circuits. Displays and buttons for settings are on the operational panel.

3-2. Cam control method

Output ON or OFF is controlled by the angle control or the timer control. In the angle control, the output has been on while the crank angle is from the ON setting angle to the OFF setting angle – (minus) 1. To avoid turning the output ON, set the same values to both the ON setting and the OFF setting. Keeping output ON is not allowed. The setting angles are 0-359°. In the TIMER control, the output has been on during passage of timer timing after the crank angle equals to the ON setting angle. If 0 is selected for the setting time, output will not be on. If one cycle of the rotary encoder takes shorter time than the setting timer, the output continues to be on. In the timer control, if the revolution direction on the display is counter-clockwise, the output will not be on. The timer timing is 0-9.99 seconds. Push the TIMER button to switch the angle control or the timer control.

The automatic advance timing can be set in the cam being in the use of the angle control. However, it cannot be set in such a cam if the timer timing has been set. Conversely, timer control cannot be set for the cam for which the advance angle time has been set.



3-3. Automatic advance angle system

The automatic advance angle system compensates the delayed time of the device controlled by its output to keep an operating angle steadily. Set the delayed time for the automatic advance timing. 0-999mS is set for the advance timing.

The automatic advance angle is calculated from the advance timing and the SPM. The ON/OFF setting angles are output during rotating, being partially altered as follows.

Output ON angle = ON setting angle −SPM×ON automatic advance timing ×0.006

Output OFF angle = OFF setting angle −SPM×OFF automatic advance timing ×0.006

The automatic advance timing is a unit of mS. The SPM above is specialized for the automatic advance angle system and calculated per revolution. While the rotary encoder is turning, it is under the control of the advance angle system.

If the interrupted rotary encoder starts to rotate, the system will start after calculating SPM.

If the input signal turns to off when 1 is set for the advanced angle with MD (device setting), the system stops. Also, the interruption of the rotary encoder stops the system.

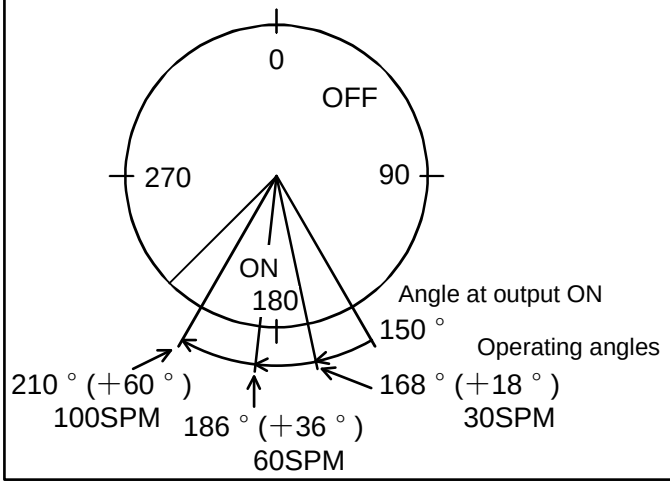
If the rotary encoder is rotating in the direction to decrease the value on the DEG display, the system will not work. Decimal numbers appearing on the ON/OFF displays means it is an advanced angle. The advance angle uses the last SPM (for one stroke earlier than the present stroke) depending on the crank angle. If used in the press machine with variable SPM, the automatic angle may not be properly advanced.

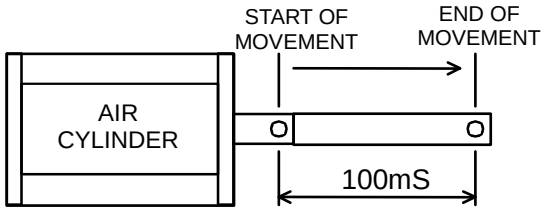
Example of the cylinder taking 100mS in moving

The description below is only for ON angle, but it applies to OFF angle likewise.

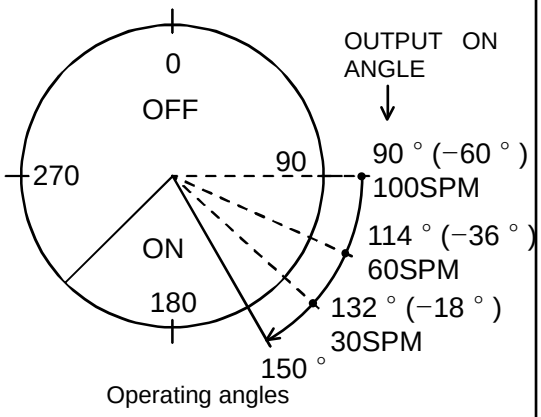
Operating angles in the case of ON at 150° are as follows.
The more the SPM is increasing, the slower the cylinder will reach the end.

Inching	150 ° (+0 °)
30SPM	168 ° (+18 °)
60SPM	186 ° (+36 °)
100SPM	210 ° (+60 °)



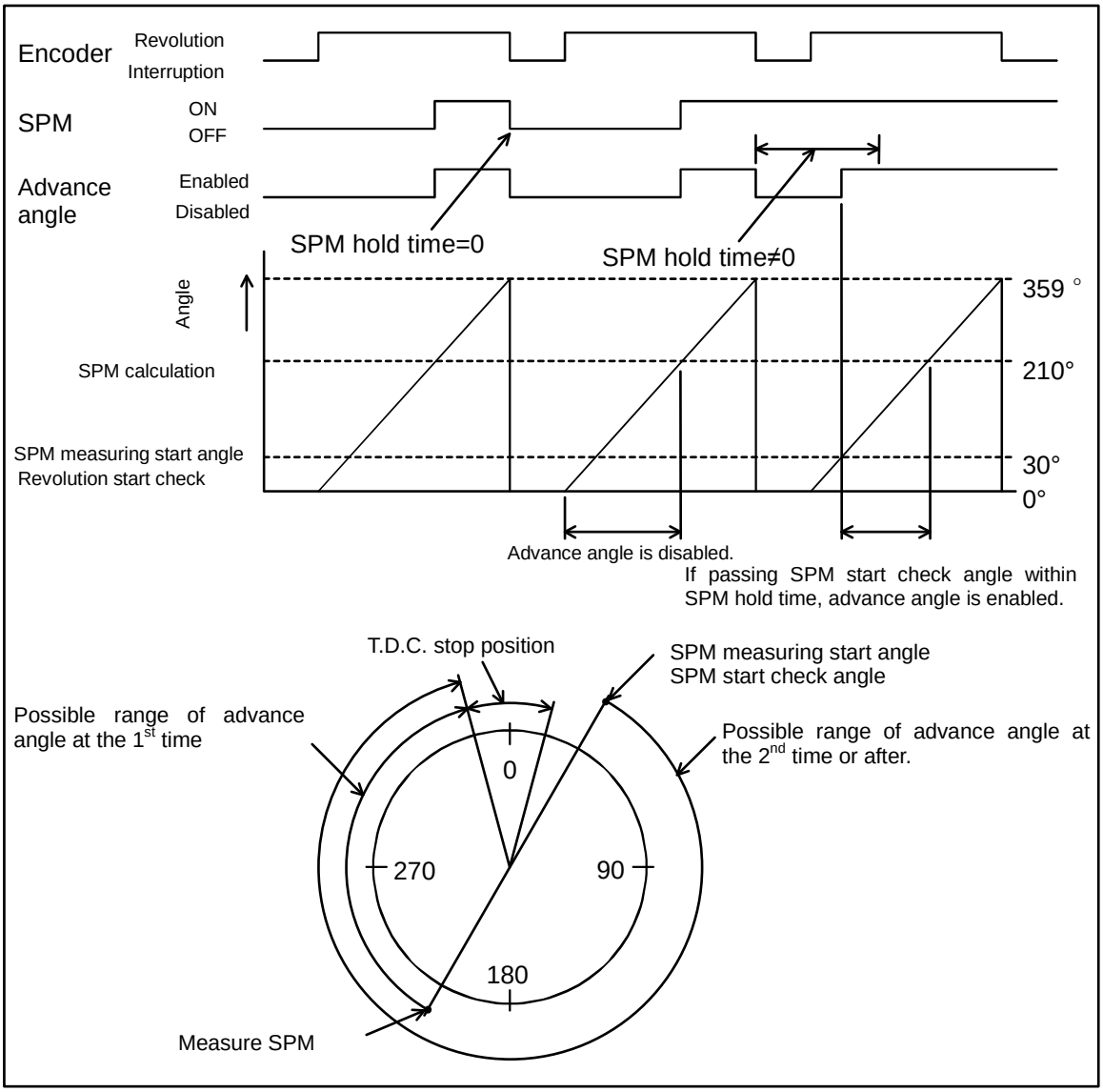


If 100mS is set for automatic advance timing, the angle for movement becomes stable.
The advance angle system works to advance the output ON/OFF angles to compensate the delayed time. It changes the advanced angles depending on SPM.



3-4. Automatic advance angle during intermittent operations

The automatic advance angle system does not work unless the SPM for advance angle has been calculated. If you need an advance angle immediately when resuming the press machine after interrupting the press machine, you have to hold the value previously calculated. For example, when the press and the feeder operate alternately, the system does not work without the stored SPM. The SPM has been stored in the memory until passing for the revolution hold time after having stopped the press machine. The automatic advance angle system starts before starting to calculate the next SPM, when the press restarts within the SPM hold time and the crank angle passes the revolution start check angle. At this time, the angle will be advanced up to the revolution start check angle. The SPM hold time means the time to hold the SPM for the advance angle after stopping the revolution. In the example of alternate operations, it sets the time from resuming the press machine after its interruption to reaching the revolution start check angle. The SPM hold time is 0-32 seconds. Holding during the power on or the backup memory can be set. The standard value is 0 second, and no automatic angle system is set during the intermittent operations in settings. The revolution start check angle is 0-359 ° . The standard value is 30 ° . Make sure that the revolution start check angle setting is set after the stop angle of the intermittent operations.



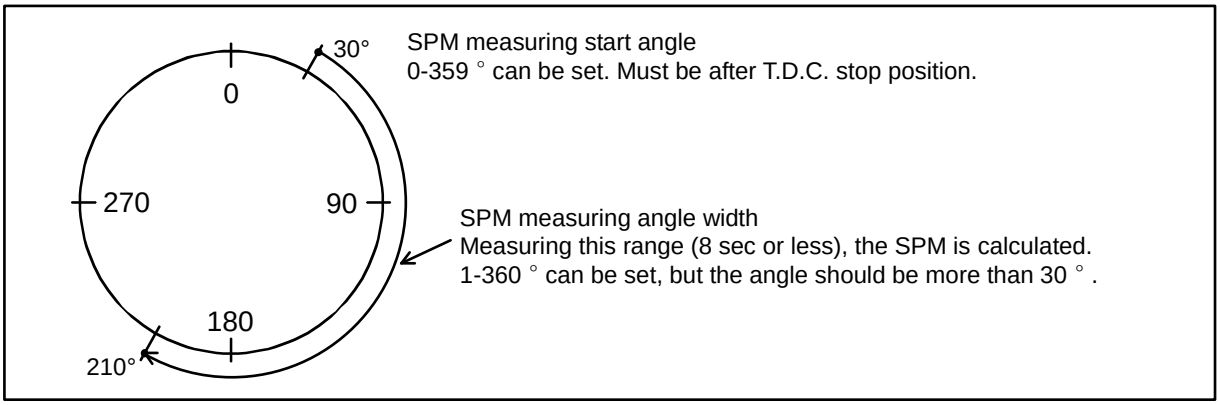
3-5. Calculation of SPM for advance angle

This calculation is derived from the time for passing the SPM measuring angle width starting from the SPM measuring start angle. However, if the revolution has stopped during its passage, the calculation will not finish.

30 ° is a standard angle to start measuring the SPM, while the 180 ° is a standard angle width to measure the SPM. In this setting, the calculation will be 210 ° . You can change these values by the device setting.

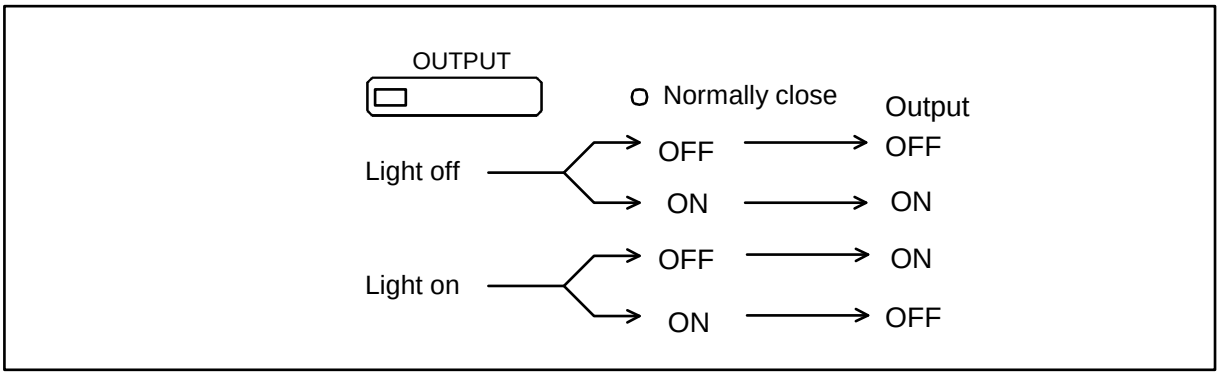
The SPM measuring start angle should be set after the T.D.C. stop position. If it is set before T.D.C. stop position, the calculation will not start from the first cycle at the start of the revolution. The range of numbers is 0-359 ° .

The SPM measuring angle width should be 30 ° or more. If the angle width is narrow, it will degrade the accuracy of the calculation. The range is 1-360 ° . However, if 360 ° is set, an angle to start measuring the SPM will become an angle of the zero phase signal of the rotary encoder.



3-6. Output polarity

Output can be turned ON or OFF for each cam by specifying normally close in output polarity, however, cam output lamps on the panel are not turned on or off.



3-7. Pattern

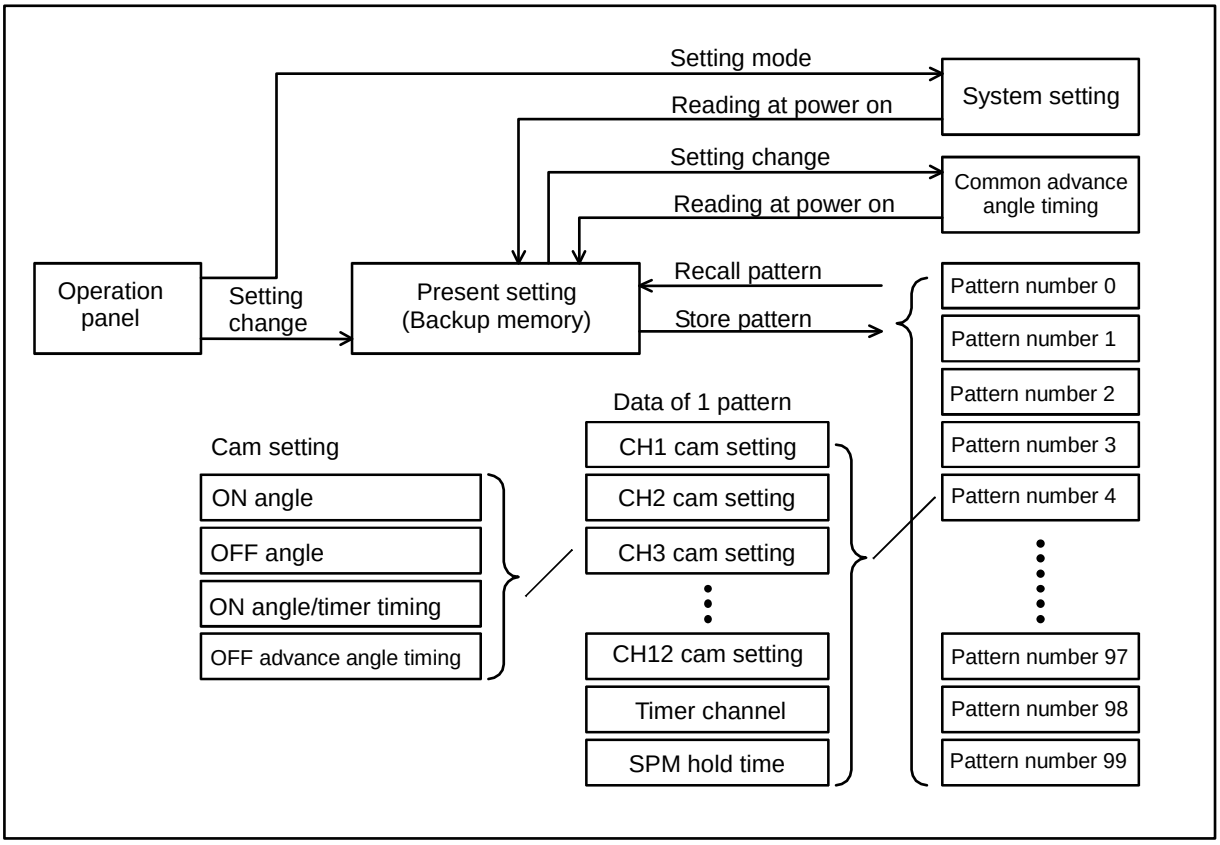
PS-731 can store cam settings for 12 channels as 1 pattern and keep patterns up to 100 in the pattern memory. One of patterns is copied into the present setting in the use of pattern. Pattern numbers are 0-99. You can store the ON/OFF setting angle, automatic advance timing, timer timing, timer setting channel and revolution hold time in the pattern memory.

Recall the pattern to copy the data of the pattern memory to the present setting. At power on, the present setting displays the data previously in use or the data specified by an operating pattern number. The operating pattern number is set by the device setting.

Cam settings are changed in the present setting. The memory data of the recalled pattern number does not change even if the data in the present setting is changing. If the setting in the present setting is changed, a decimal digit appears in the lower digit of the pattern number. In the cam whose setting is changed, a decimal point is shown in the lower digit of the cam number. Such indications are deleted by recalling the pattern or storing pattern to the pattern number presently displayed.

Select the pattern number and store the pattern to store the data of the present setting in the pattern memory. The data of the present setting replaces the memory specified by the pattern number.

The memories for patterns are stored by EEPROM and will be able to be saved for 10 or more years, but the data in the present setting is backuped by batteries and will disappear after approximately 2 weeks.



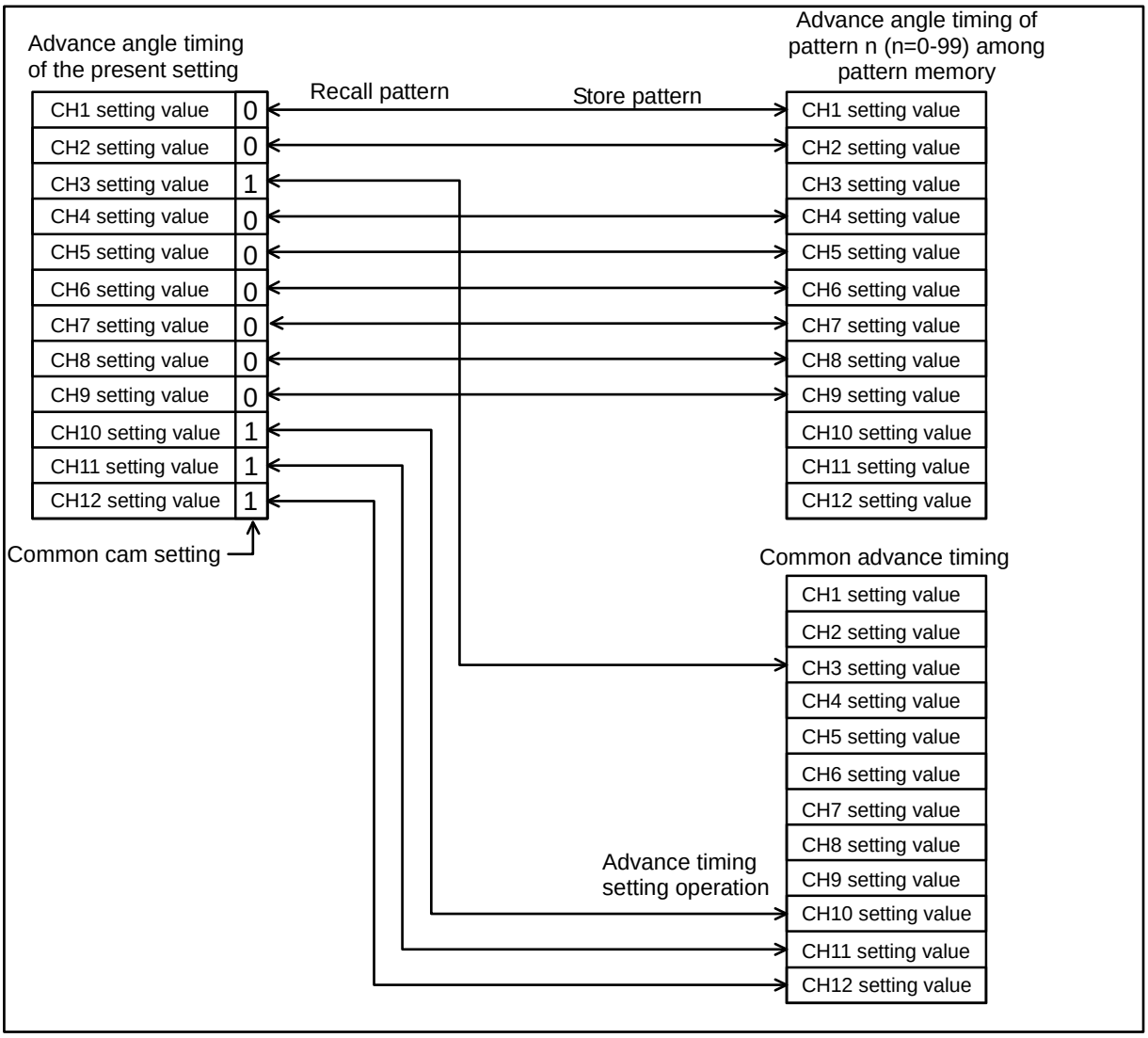
3-8. Common cam

Common cam is to prevent the automatic advance timing set in the cam from changing by the pattern operations. The advance angle timing of the cams for which the common cam has been set is used as a value of the common cam timing memory, which means that the same setting are applied to the all patterns. Only one set of the common advance timing can be stored for each cam in the common cam timing memory, and it cannot be changed by pattern operations. If you change the automatic advance timing of the cam with the common cam setting, the data is stored in the common cam memory at the same time when you set the automatic advance timing. The data in the common cam timing memory is copied to the present setting at the same time of the power on.

As for the cam for which the common cam has not been set, its advance angle timing is recalled or stored in the pattern memory together with other cam settings by the pattern operation. To indicate the cam with the common cam setting, the decimal point of the higher digit appears on the cam number. Even if the advance angle timing of the cam with the common cam setting is changed, a decimal point indicating setting changes does not appear.

The cam with the common cam setting cannot be switched to the timer control.

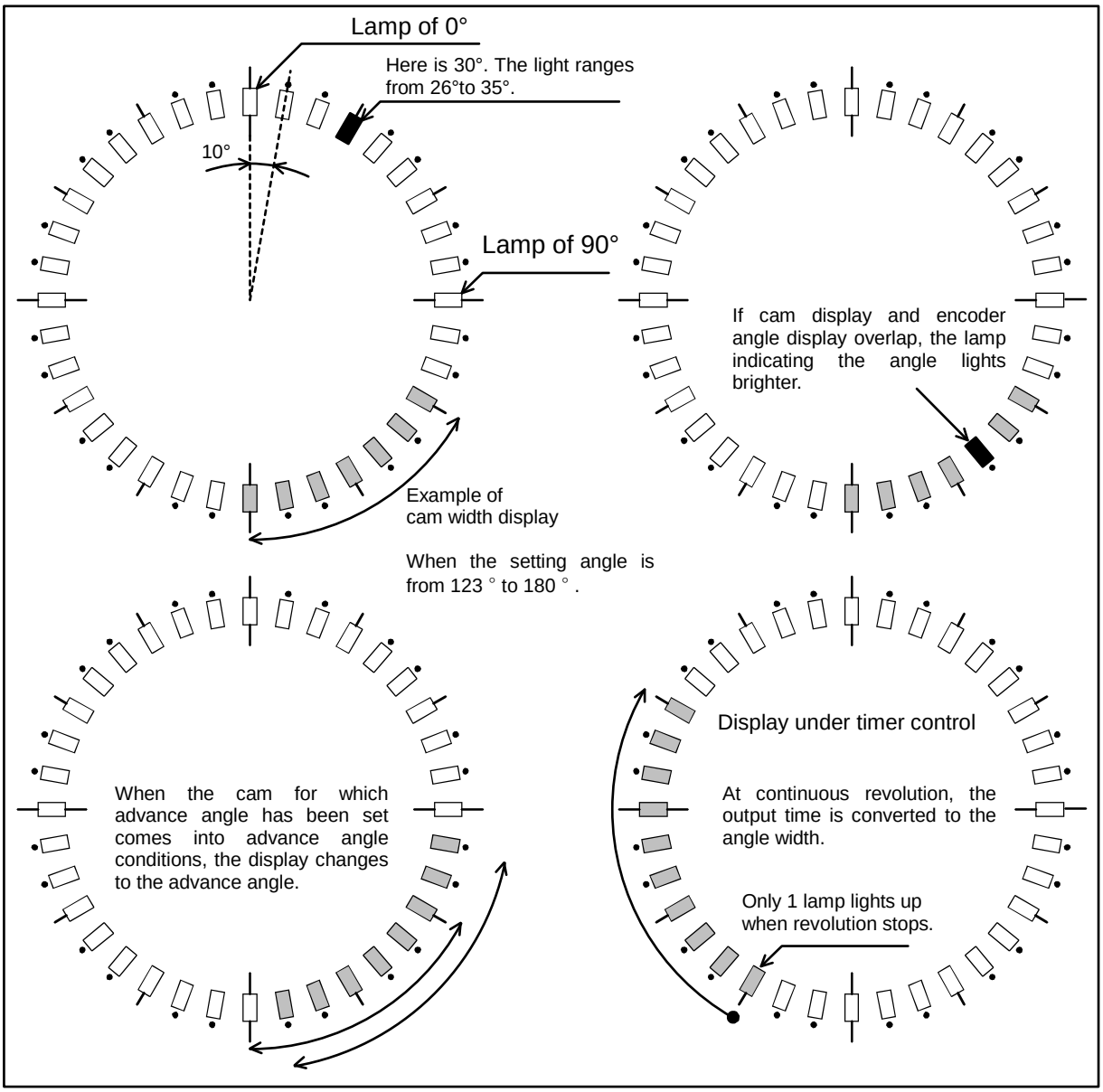
The common cam setting is set for each cam. Refer to the device setting.



3-9. Angle/cam width display

The roulette angle display has 36 lamps in 1 cycle. Lamps are positioned in steps of 10 ° , one lamp ranges an angle of -4 ° to 5 ° . For example, the lamp at three o'clock is an angle of 90 ° , having a range of 86 ° to 95 ° . To show the angle of the rotary encoder, one of 36 lamps lights up. All lamps corresponding to the angles from ON angle to OFF angle light up, when the setting angle of the cam is displayed by the CAM DISPLAY button. When the automatic advance timing is set in the cam, the setting angle is shown when advance angle is disabled; however, the advance angle is shown when coming into the advance angle conditions. While the cam width is displayed under timer control, when the revolution stops, only 1 lamp lights up, however, at the continuous revolution lamps light up indicating the cam width for the time corresponding to the SPM.

If you select cam display, when the lamp indicating the rotary encoder's angle is within the lamps indicating the setting angle, the lamp of the angle becomes brighter than other lamps. By the device setting, you can avoid display the angle and the cam display simultaneously.

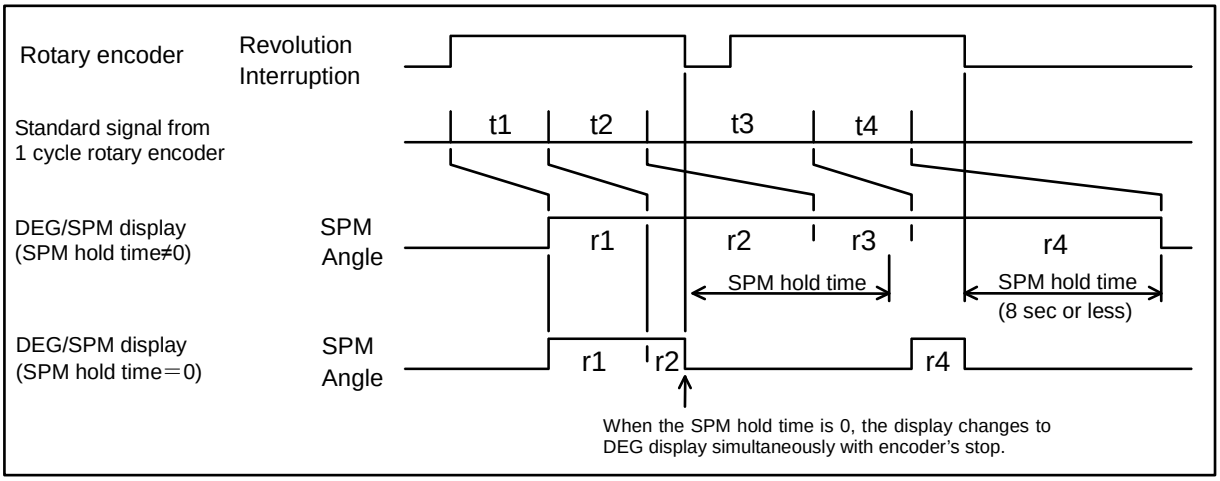


3-10. SPM on display

The SPM on the DEG/SPM display is calculated from the time of one cycle revolution of the rotary encoder. If one revolution takes 8 seconds or more (less than 8 SPM), the SPM is not displayed. In less than 100 SPM, it is shown with one place of a decimal point. In 100 SPM or more, it is shown with integer numbers. In 1,000 SPM or more, it is shown with last 3-digit.

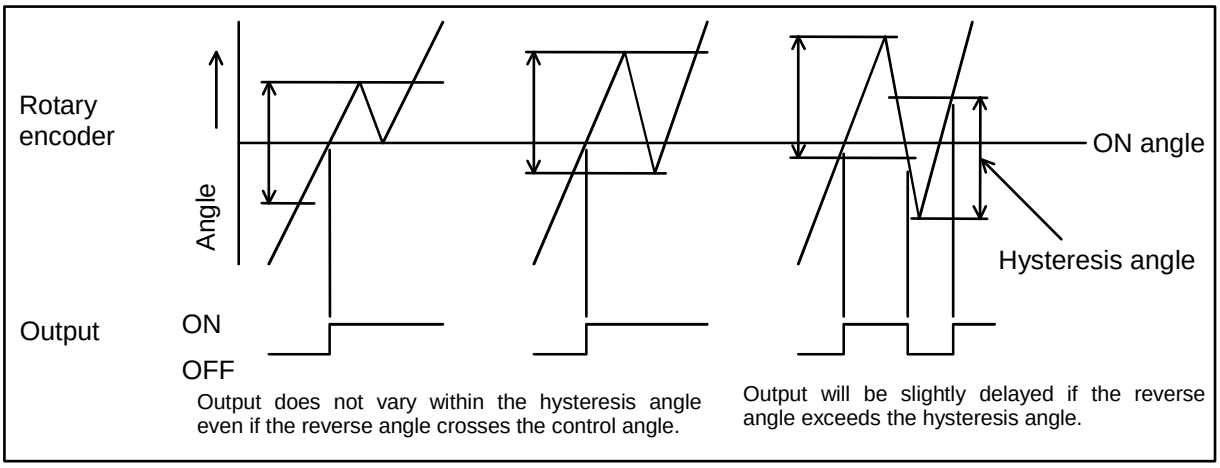
The SPM on display can be calculated even if the rotary encoder does not make one revolution continuously, for example, the average strokes are displayed in the alternate operation of the press and the feeder. The SPM has been displayed at completion of the calculation. After the rotary encoder stops turning, it has kept displayed, until passing the SPM hold time or for 8 seconds, whichever is shorter. When the revolution hold time is set to 0mS, it changes to the DEG display at the same time when the revolution stops.

The SPM used for calculating the automatic advance angle is separately calculated with the SRM for display.



3-11. Hysteresis function

PS-731 has hysteresis function to avoid changing in output even if reverse revolution occurs temporarily due to vibration or play of shafts of the rotary encoder installed to the press machine. The output does not vary as long as the reverse angle from the rotary encoder is within the hysteresis angle. The hysteresis angle is set from 1° to 16°. The standard value is 3°.

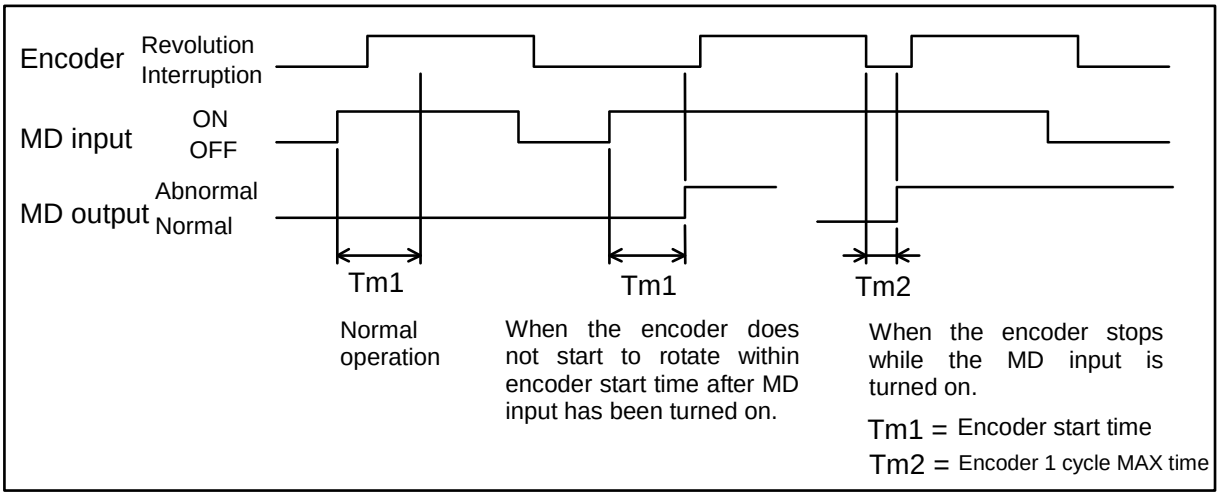


3-12. Motion detect function

PS-731 has the motion detect functions; encoder starting check, encoder 1 cycle MAX time check and SPM down limit check. If an abnormal condition is detected through the checks, the MD output is turned to OFF. The MD output becomes turned on at the power supply on.
The encoder starting check is to detect revolution signals from the rotary encoder, if not detecting them within the encoder starting check time; it judges it as an abnormal condition. The encoder starting check time should be 0-999mS. The standard value is 200mS.
The encoder 1 cycle MAX time check is to check the time of 1 cycle encoder's revolution. If it exceeds over the encoder 1 cycle MAX time, after having passed the encoder starting check time, it judges as an abnormal condition. The encoder 1 cycle MAX time can be 0-999mS. The standard value is 100mS.
The above two checks are released when the MD input is turned to off.
The SPM down limit check is to compare the present SPM with the last SPM (for one stroke earlier than the present stroke) every time the SPM for the advance angle has been calculated.

If the last SPM×SPM down limit ＜the present SPM, it is normal.

The SPM down limit is for continuous operations, not during intermittent operations.
The SPM down limit should be 0-99%. The standard value is 0%.



Encoder starting check, encoder 1 cycle MAX time check

3-13. Advanced angle with MD

Advanced angle with MD function means detecting the interruption of the press machine by checking the timing of turning MD input off. At this time, the MD input has to be connected to the relay for clutching or the equivalent relay. Using the MD input will be faster to detect than using signals from the rotary encoder.
Select 1 in the advance angle with MD function by the device setting. When 0 is selected, nothing occurs even if the MD input is turned off.

3-14. Setting change inhibition

To inhibit setting change, there are two methods: by using device settings or by the terminal of the terminal block on the back. In the former method, you can prohibit setting for each cam.

In the latter method, you are allowed only to display the setting value by changing cam numbers and switch display roulette lamps. If you set inhibition function during changing settings, the inhibition will become effective after completing the operations.

3-15. Rotary encoder failure detection

An incremental rotary encoder is used in PS-731. PS-731 always monitors correlation of three signals from the encoder and turns MD output off if an abnormal condition is detected. The device also has the motion detect function to observe operations of the encoder by the use of MD input signals. The functions above are able to detect a fair percentage of rotary encoder failure.

3-16. Device setting

Device settings are for changing PS-731's system settings. According to your needs, you can change them. Device settings should be conducted during the setting mode. The values set in the setting mode can be stored in the EEPROM and will be stored for a long term. Refer to *7. Device setting*.

4. Operation

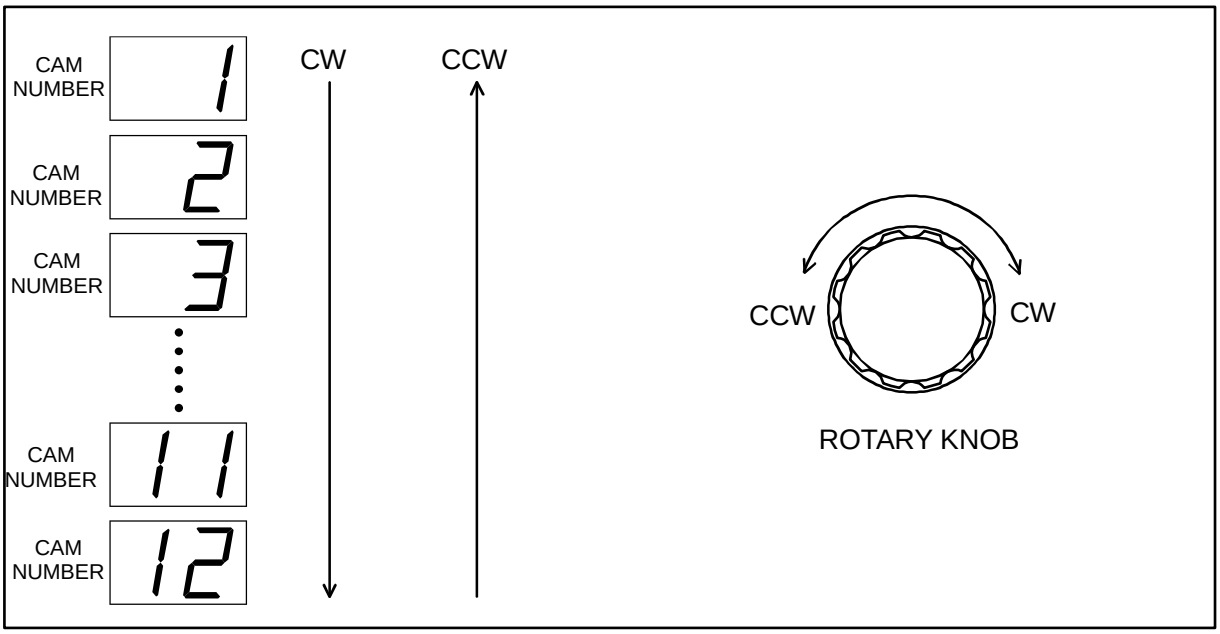
4-1. Changing cam number, angle/timer setting display

Confirm that the number display is not blinking. Turn the rotary knob to select the cam number of which you wish to change setting. Turn the knob clockwise to increase the cam number and counter-clockwise to decrease. Cam number changes from 1 to 12.

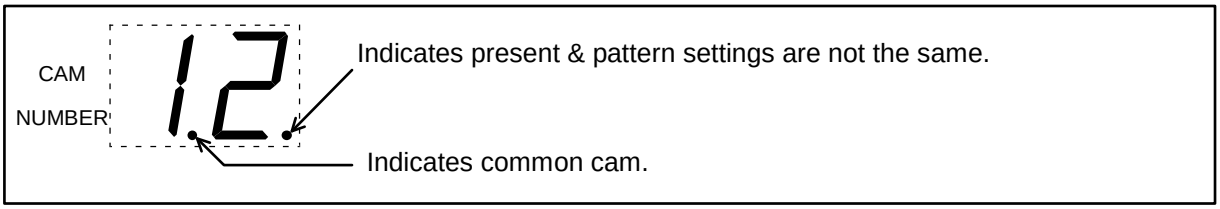
Decimal numbers may appear on the cam number. The higher decimal point shows that a common cam is selected. The lower decimal point indicates that the present settings in use are different from the stored pattern's setting.

ON/OFF displays the number being set to ON and OFF for that particular cam. When the TIMER lamp lights, the ON displays the start angle and the OFF represents the timing set.

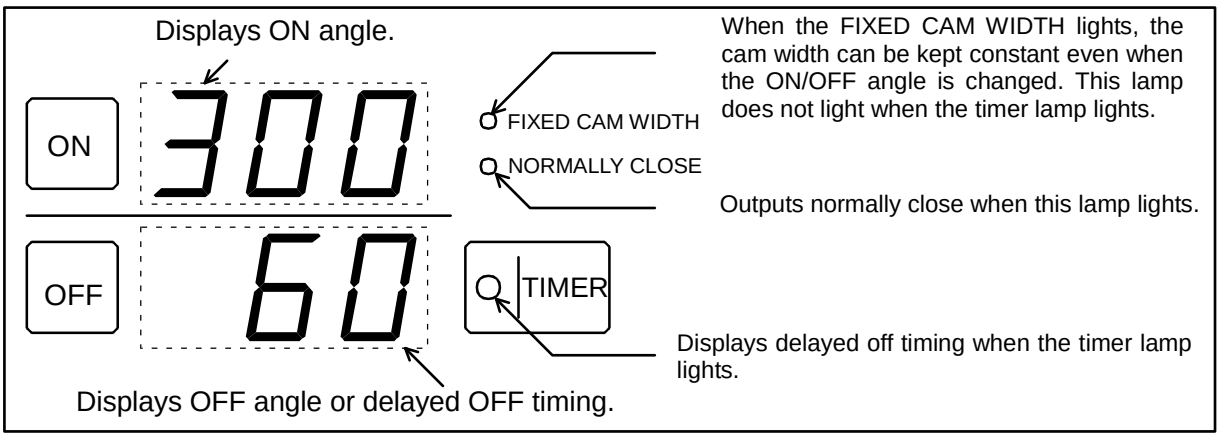
FIXED CAM WIDTH, NORMALLY CLOSE lamps display the mode of the cam.



Change of cam number



Decimal points of cam number display

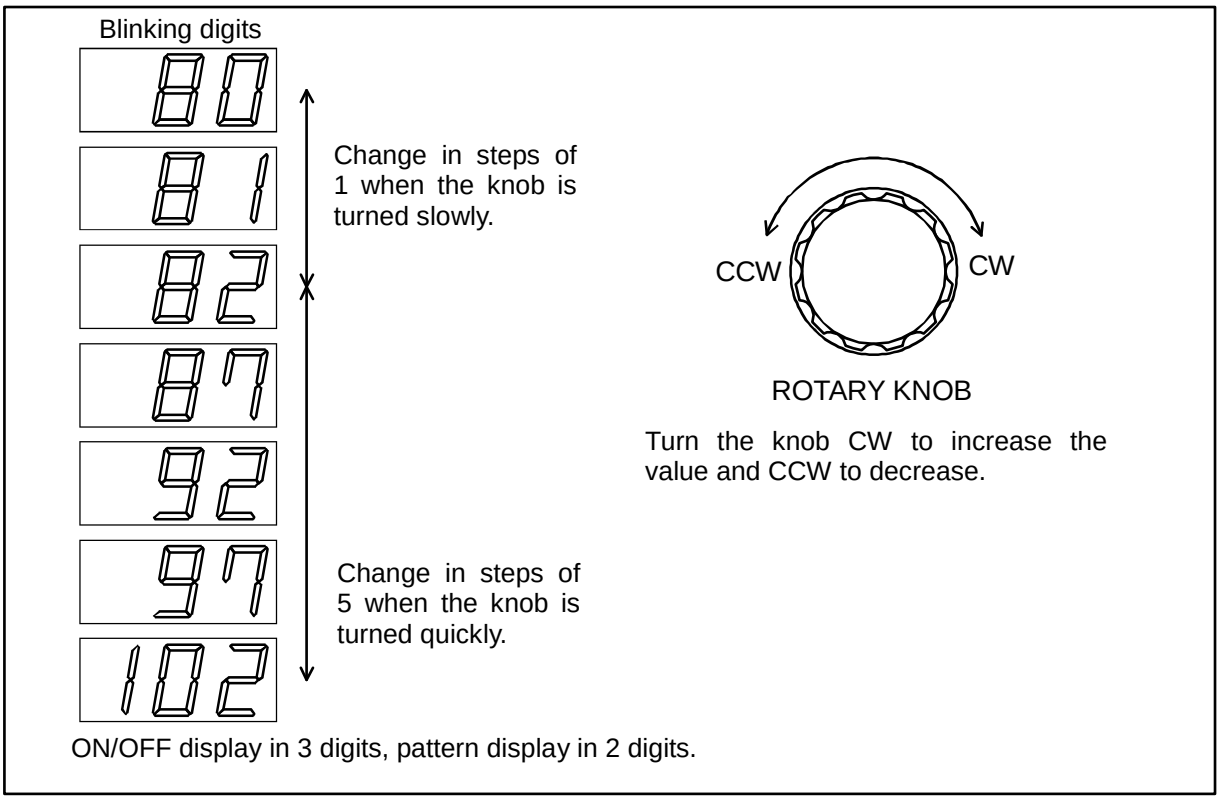


Display of cam setting

4-2. Change blinking digits

After setting the cam number, use the rotary knob to change the blinking digits for setting cam angle and others. Turn the knob clockwise to increase the value and counter-clockwise to decrease. Turn the knob slowly to change the value in steps of 1. Turn it quickly to change the value in steps of 5.

Pattern number, cam angle ON/OFF can be changed by changing the blinking numbers.



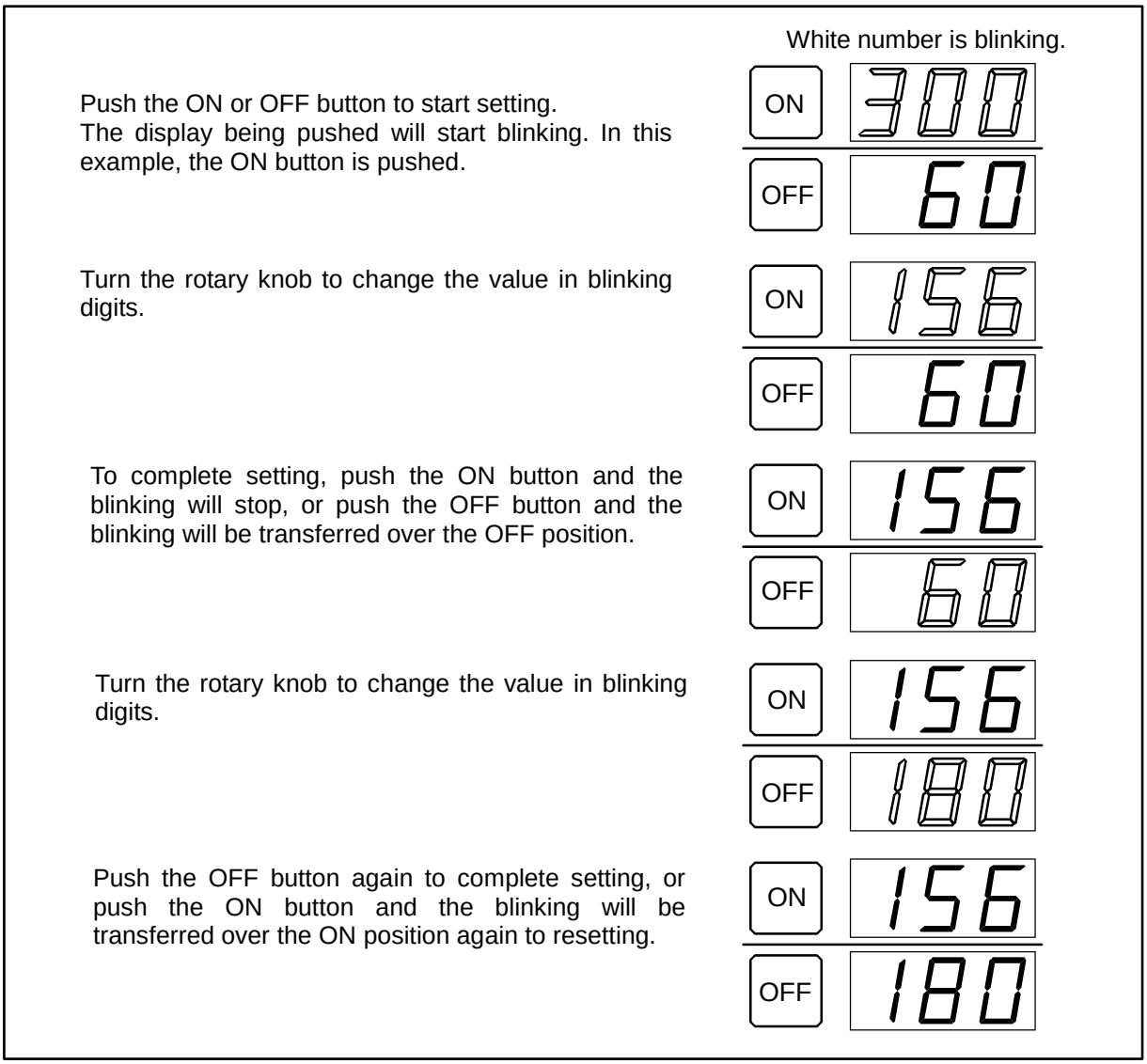
Change of blinking number

4-3. Cam angle setting

4-3-1. ON/OFF setting

Select the cam number to be set.

When the FIXED CAM WIDTH lamp does not light, push the ON or OFF button and the digits corresponding to that button will start to blink. Next, turn the rotary knob to change the blinking digits to the desired value. Push the button again and confirm that the blinking stops. The setting is completed when the blinking stops. Push the other button and the blinking will be transferred over. Again, turn the rotary knob to set to desired value.

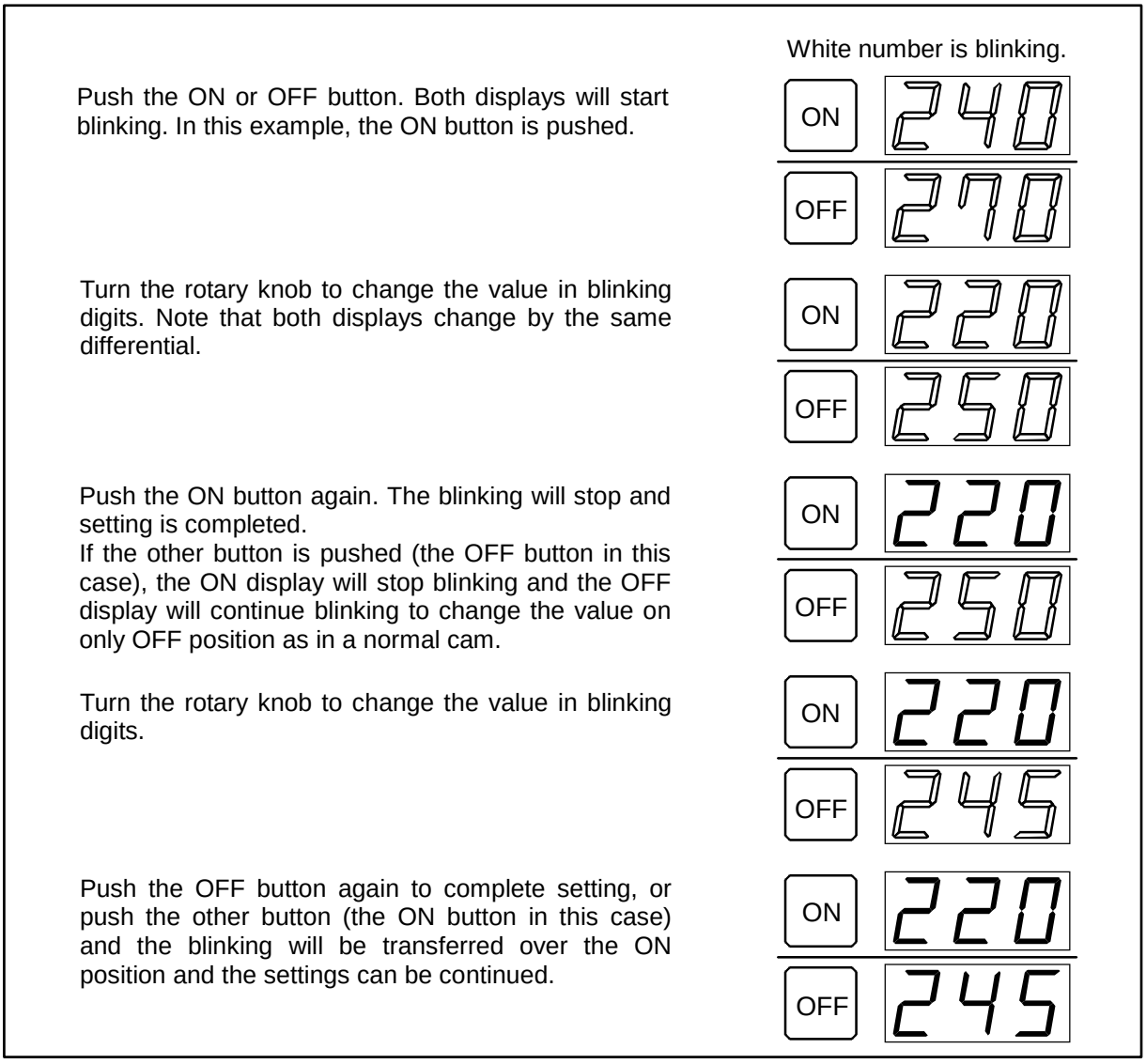


Example of ON/OFF setting

4-3-2. FIXED CAM WIDTH setting

When the FIXED CAM WIDTH lamp lights, push the ON or OFF button and both of them will start to blink together. Turn the rotary knob and both the ON and OFF blinking digits will change by the same differential. In this way, the cam width can be kept constant even when the ON/OFF angle is changed.

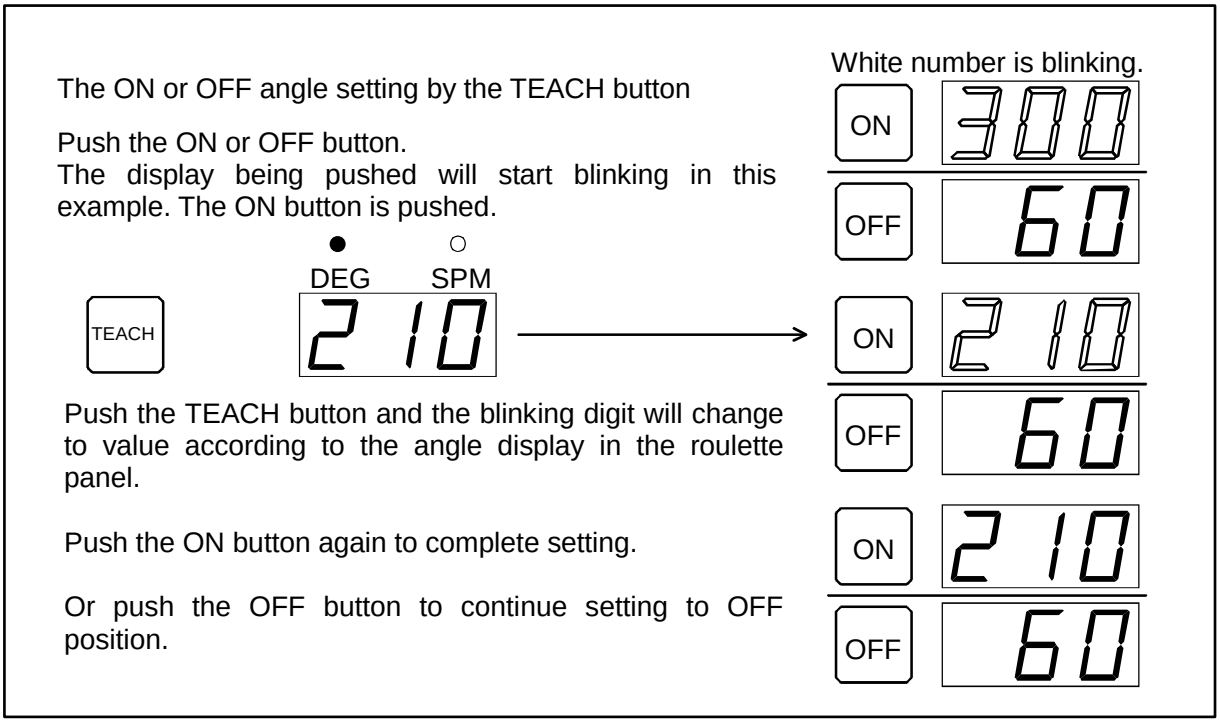
Push the same button again and the blinking will stop to show completion of setting. If you push the ON button to start the setting and then push the OFF button while the digits are still blinking, only digits corresponding to the OFF button will continue to blink. Turn the rotary knob and the blinking digits value will be changed. Push the same button to complete setting. In this case, the cam width can also be changed in the FIXED CAM WIDTH mode.



Example of FIXED CAM WIDTH setting

4-3-3. ON/OFF angle setting using TEACH button

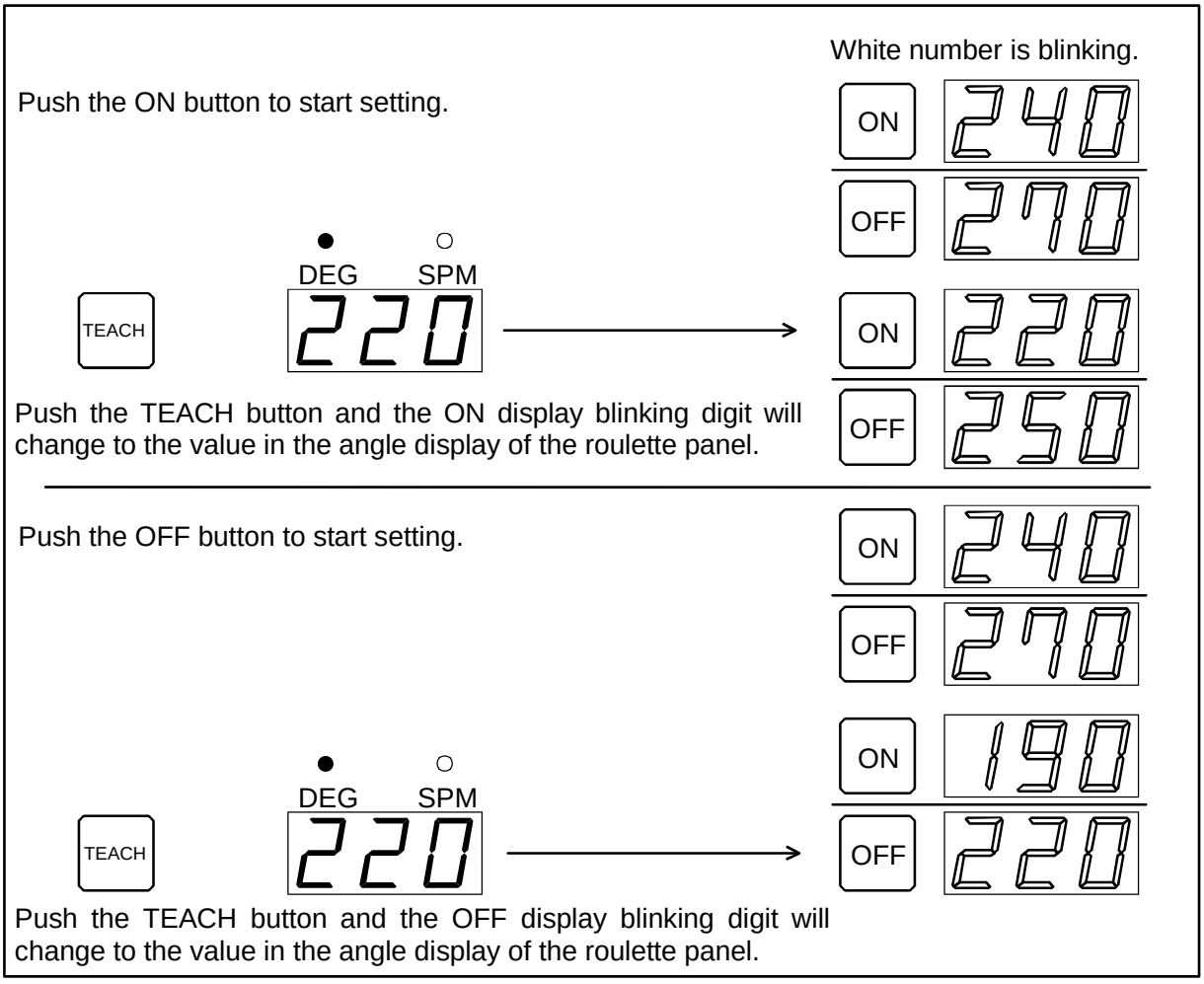
The TEACH button can be used to set the angle ON/OFF to encoder's present position when the press machine is stationary on the inching mode. Select the cam number to be set. When the FIXED CAM WIDTH lamp does not light, push the ON or OFF button and the corresponding digits will start to blink. Push the TEACH button and the blinking digits will change to the value being display in the roulette display panel. The rotary knob can also be used to set the desired position.



Example of using TEACH button

4-3-4. FIXED CAM WIDTH setting using TEACH button

Select the cam number to be set. When the FIXED CAM WIDTH lamp lights, push the ON or OFF button and both the ON/OFF digits will start to blink. Push the TEACH button and the blinking digits will change to the value being displayed in the roulette display panel and at the same time set the cam width by itself. Take note of the button (ON or OFF) being pushed first. For example, if ON button is being pushed first, then the blinking digits of the ON button will change to display panel's value when the TEACH button is pushed. The OFF button blinking digits will change to the value being programmed in the FIXED CAM WIDTH.



Example of FIXED CAM WIDTH setting by TEACH button

4-3-5. To stop setting

To stop setting at any time, push the CAM DISPLAY/CANCEL button. The digits that are blinking will return to its previous value and blinking stops.

4-3-6. ON/OFF setting limits, others

The display corresponding to the ON button shows the digits in angle 0-359°. For the OFF display, when the TIMER lamp does not light, the digits are 0-359°. When the TIMER lamp lights, the display shows 0-999 msec.

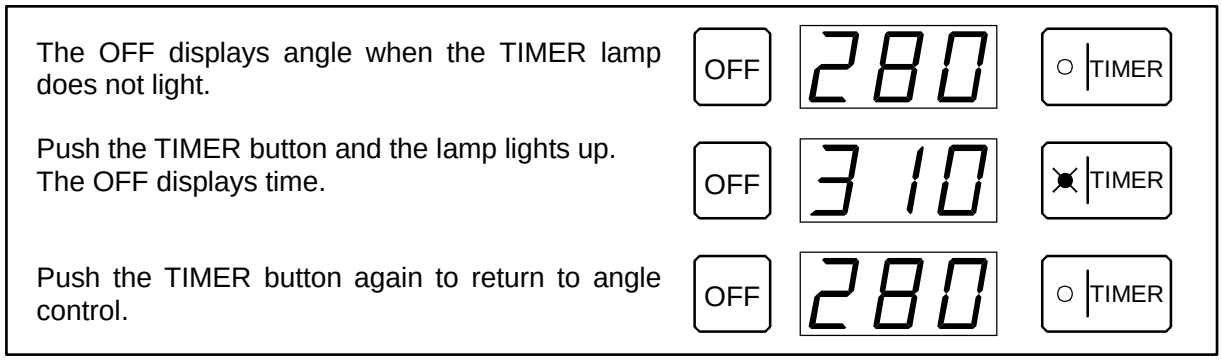
The TEACH button can be used for setting the ON angle anytime as the display is always in degrees. For the OFF display, the TEACH button can be used only when the TIMER lamp does not light.

4-4. Timer setting

4-4-1. ANGLE/TIMER control switching

The cam output can be selected as ANGLE or TIMER which is indicated by the timer control. The cam output is in the angle mode when the TIMER lamp does not light. The timer mode is on when the lamp lights. Push the TIMER button for 2 seconds to switch over from ANGLE to TIMER and vice versa.

The timer control cannot be selected if the cam is set for automatic advance timing. If timer control is required for that cam, set the automatic advance timing to 0.

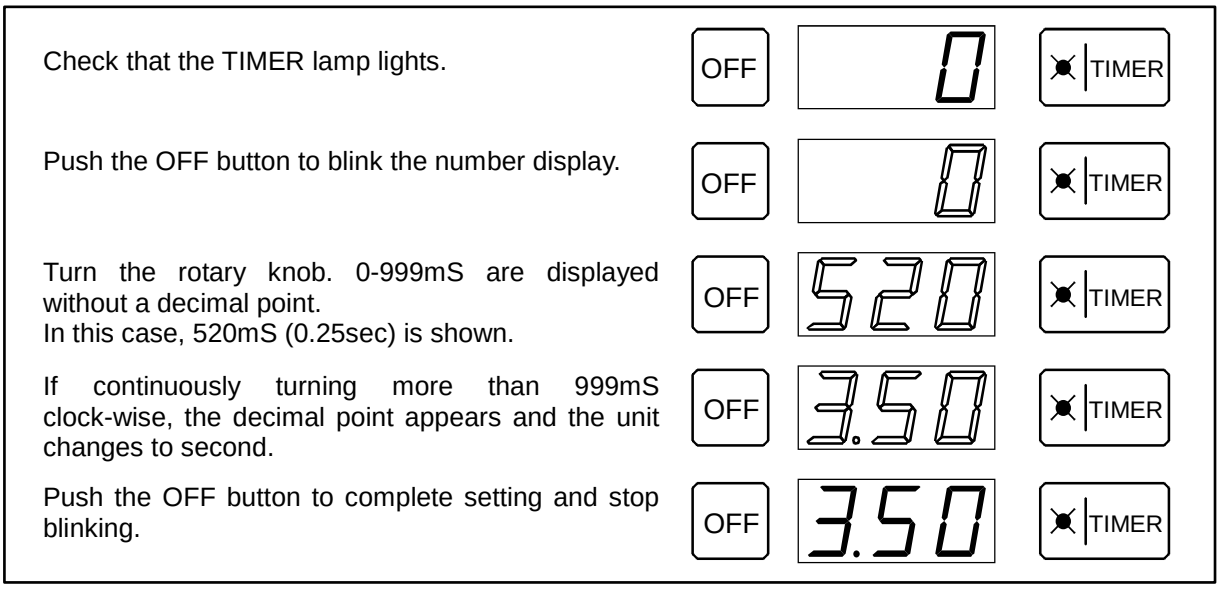


How to switch ANGLE/TIMER control

4-4-2. Timer setting

Make sure that the cam to be set is under timer control and then push the OFF button. Turn the rotary knob and change the blinking values. If a decimal point shows up on the number display, 1.00-9.99[sec] can be set; if not, 0-999 [ms] can be set. The range of the setting changes automatically.

Push the OFF button after selecting the value to end the setting. To return to the value before the setting and interrupt the setting, push the CANCEL button.



Example of timer setting

4-5. Automatic advance timing setting

The automatic advance timing can be set for each individual cam's ON or OFF.

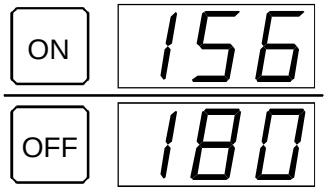
Select the cam number to be set. Push the ON or OFF button while pushing the FUNCTION button at the same time. The digits corresponding to the button being pushed will start to blink. Turn the rotary knob to set the blinking digits to the desired value. Push the same button again and the blinking will stop to show completion of setting. If the other button is pushed, the blinking will be transferred over. Turn the rotary knob to set to the desired value and then push the button to complete setting.

Push the CAM DISPLAY/CANCEL button to stop setting. The display will return to the previous value and the blinking stops. The automatic advance timing can be set 0-999 msec.

The automatic advance timing can only be set when the cam is in the angle control mode. If the particular cam is in the timer control mode, set the timing to 0, switch over to angle control and then set the automatic advance timing.

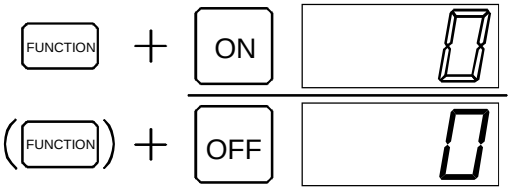
White number is blinking.

Turn the rotary knob to select the cam number.

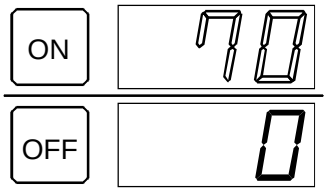


Push the ON or OFF button while pushing the FUNCTION button. The display being flashed will start blinking in this example.

Push the ON button with the FUNCTION button. The display shows automatic advance time.

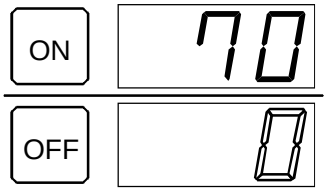


Turn the rotary knob to change the value in the blinking digit to set the automatic advance time in the ON position.

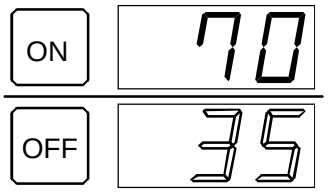


Push the other button and the blinking will be transferred over in this example.

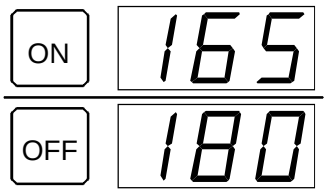
The OFF button is pushed, and the OFF display starts to blink.



Turn the rotary knob to change the blinking digit of the automatic advance time in the OFF position.



Push the OFF button again to complete setting.

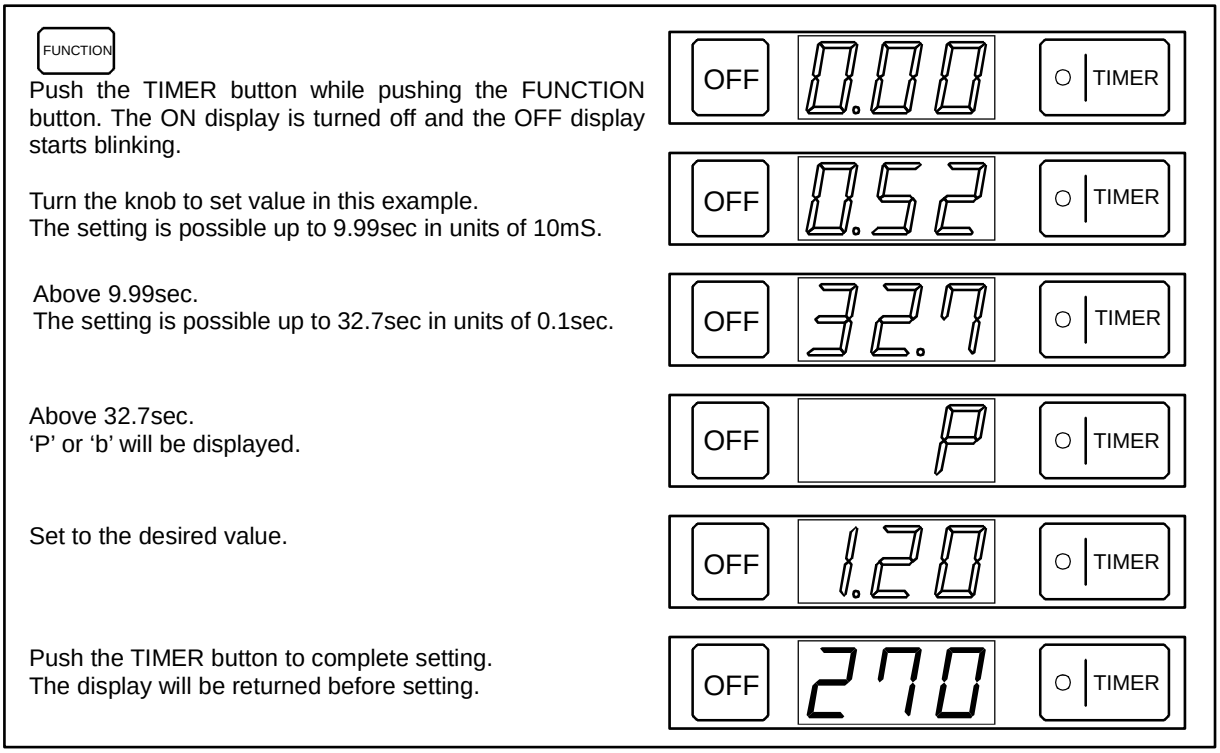


Example of automatic advance time setting

4-6. Revolution hold time setting

Check that the display is not blinking. Push the TIMER button while pushing the FUNCTION button at the same time. The ON display will go off and the OFF display digits will start to blink. Turn the rotary knob to increase or decrease the value. Push the TIMER button again to complete the setting.

The revolution hold time can be set for from 0.00 to 32.7 sec. From 0.00 to 9.99 sec, the unit is in 0.01 sec. From 10.0 to 32.7 sec, the unit is in 0.1 sec. If the rotary knob is turned beyond 32.7 sec, 'P' or 'b' will be displayed.



Example of revolution hold time setting

4-7. Pattern operation

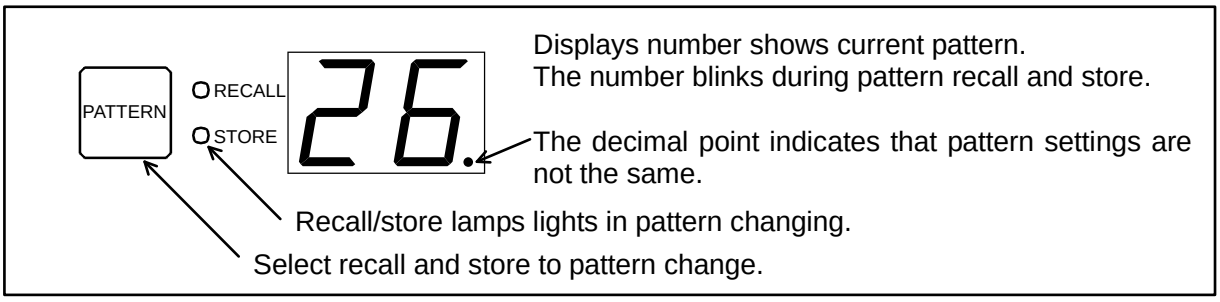
Pattern operation is impossible when the encoder is rotating. Make sure to stop the press machine before performing pattern operation.

When the RECALL and STORE lamps are out, push the PATTERN button once and the RECALL lamp will light up. Push the PATTERN button again and the STORE lamp will light up instead. If you push the button one more time, the RECALL/STORE lamp goes off and it returns to the previous status. The pattern number starts blinking when either the RECALL or STORE lamp lights.

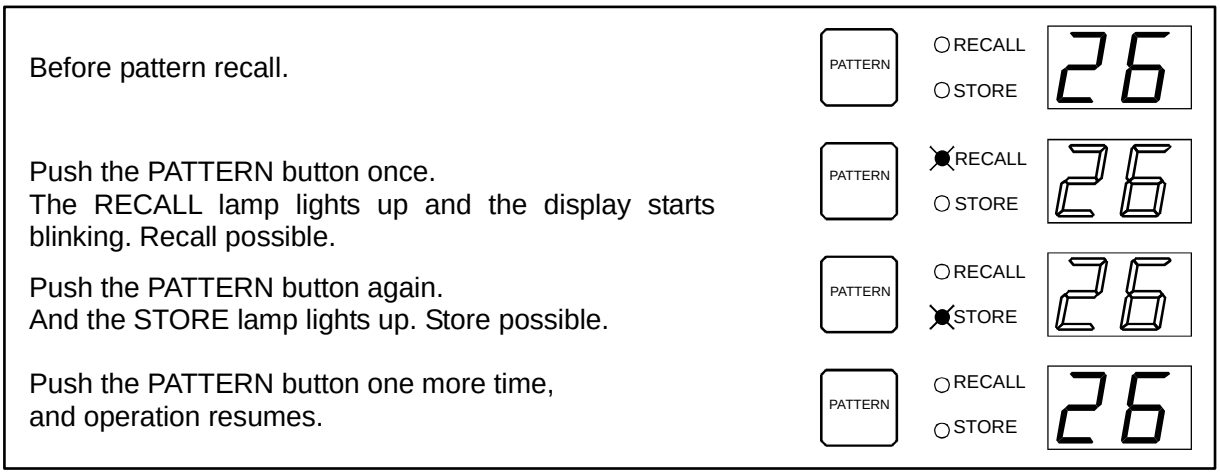
If the CAM DISPLAY/CANCEL button is pushed during the pattern operation, the display will return to its previous value.

When a decimal point of the pattern number lights, it indicates that the present value and the stored pattern are not the same.

When the pattern operation is completed, the RECALL and STORE lamps go off. The MD output will then resume approximately 1 sec.



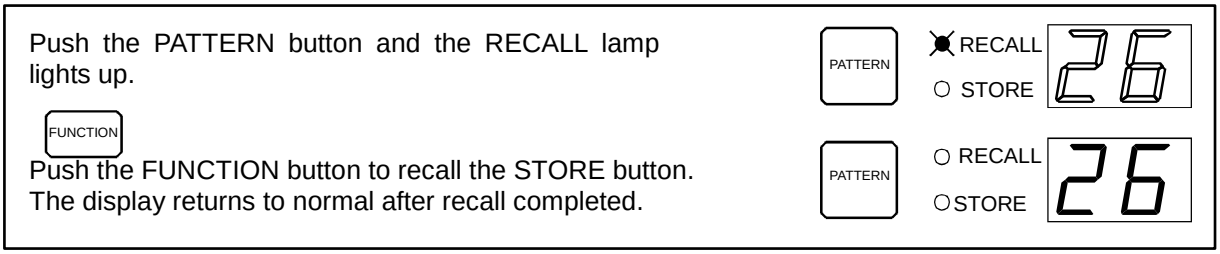
Display of pattern operation pattern



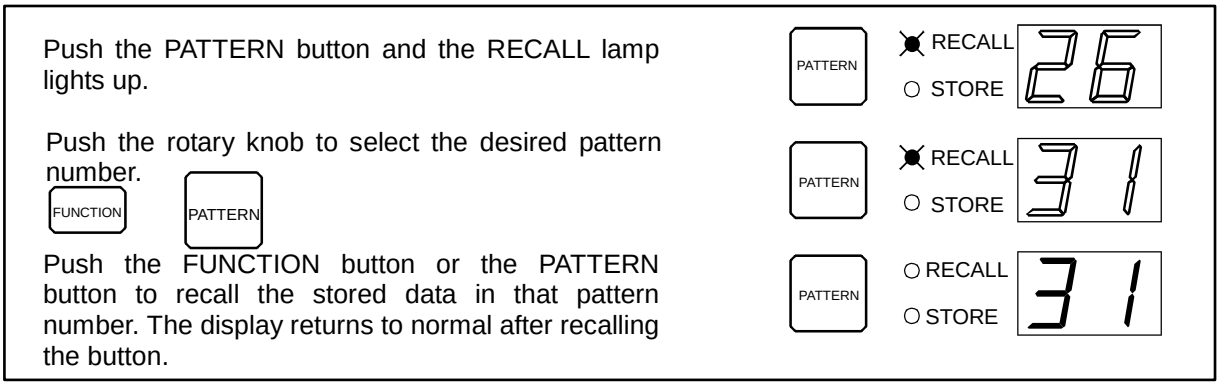
Pattern selection

4-7-1. Pattern recall

Push the PATTERN button and the RECALL lamp will light up. If you wish to recall the pattern number that is immediately being displayed without turning the rotary knob, just push the FUNCTION button. If not, turn the rotary knob to select the desired pattern number. Next, push the FUNCTION or the PATTERN button and the data stored in that pattern number will be recalled and transferred to the present settings.



Recall from displayed pattern number

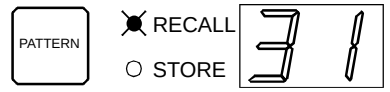


Recall with pattern number changed

4-7-2. Pattern store

Push the PATTERN button to make the STORE lamp light up. If you wish to store the present settings into the pattern number that is immediately being displayed, just push the FUNCTION button. If not, turn the rotary knob to select the desired pattern number. Next, push the FUNCTION or the PATTERN button and the present settings will be stored into that pattern number being displayed.

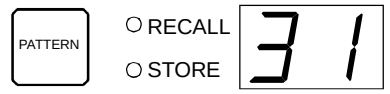
Push the PATTERN button and the RECALL lamp lights up.



Push the PATTERN button again and the STORE lamp lights up.

FUNCTION

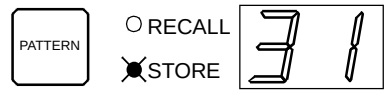
Push the FUNCTION button and the data are stored.
The display returns to normal after store completed.



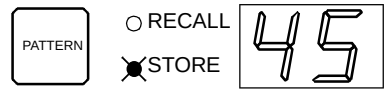
Store the data in the same pattern number

Push the PATTERN button and the RECALL lamp lights up.

Push the PATTERN button again and the STORE lamp lights up.



Turn the rotary knob to select the desired pattern number.



FUNCTION PATTERN

Push the FUNCTION button or the PATTERN button and the data are stored in that pattern number.
The display returns to normal after pattern store completed.

Store the data with pattern number changed

4-8. Cam display

Setting of the cam set by the cam number is displayed in the roulette angle display. Push the CAM DISPLAY button.

4-9. Release from error

You can release error by pushing the CAM DISPLAY/CANCE button. If several errors occur, push the button for the number of times of the errors.

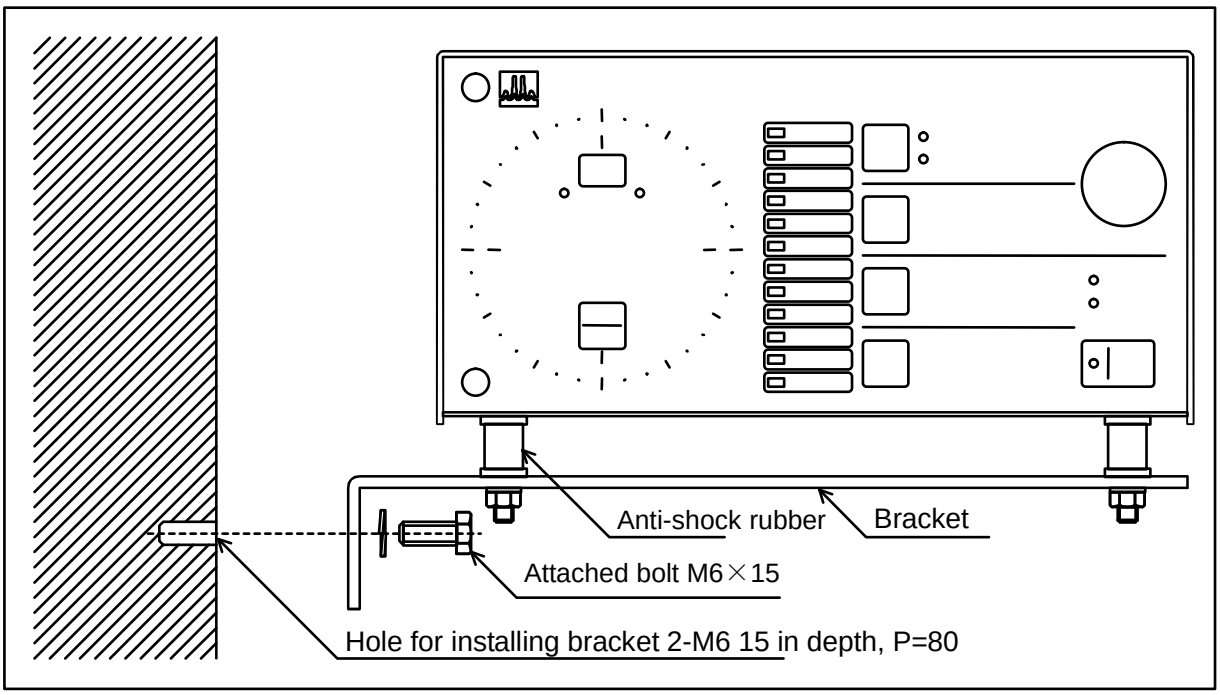
5. Installation

5-1. Installing control box

Use a special bracket or stack on our other products to install the digital cam. Select an installation place with less vibration and dust. Be sure to ground the chassis.

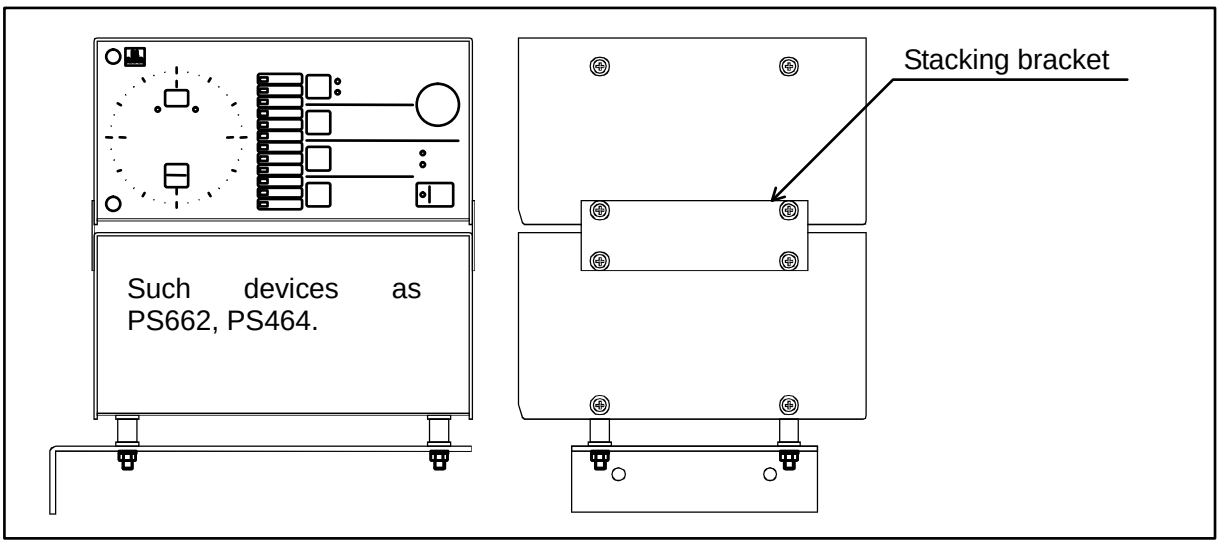
5-1-1. Use of special bracket

Use 2 bolts to install with a special bracket. Fix the digital cam to the bracket with anti-shock rubbers.



5-1-2. Stacking PS-731 on other device

Place an order separately for a stacking belt.

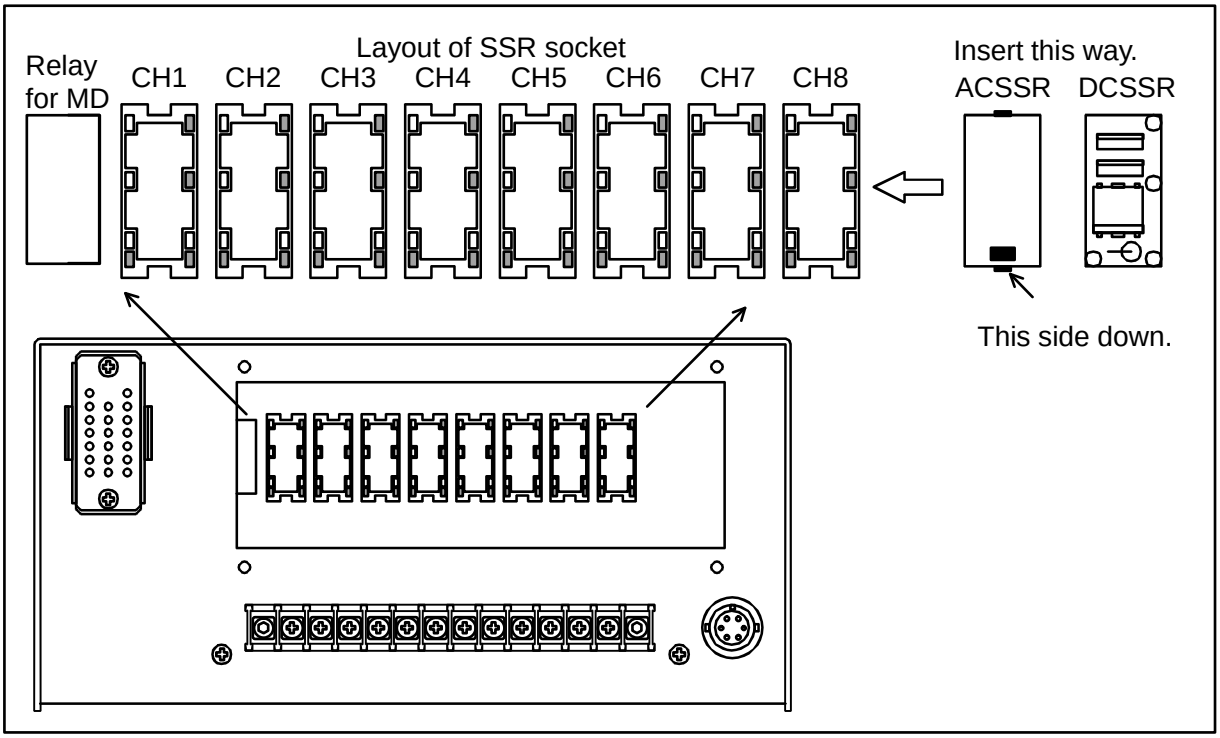


5-2. Inserting SSR

Remove a back panel to insert SSRs to the socket.

Choose ACSSR or DCSSR according to load to be used.

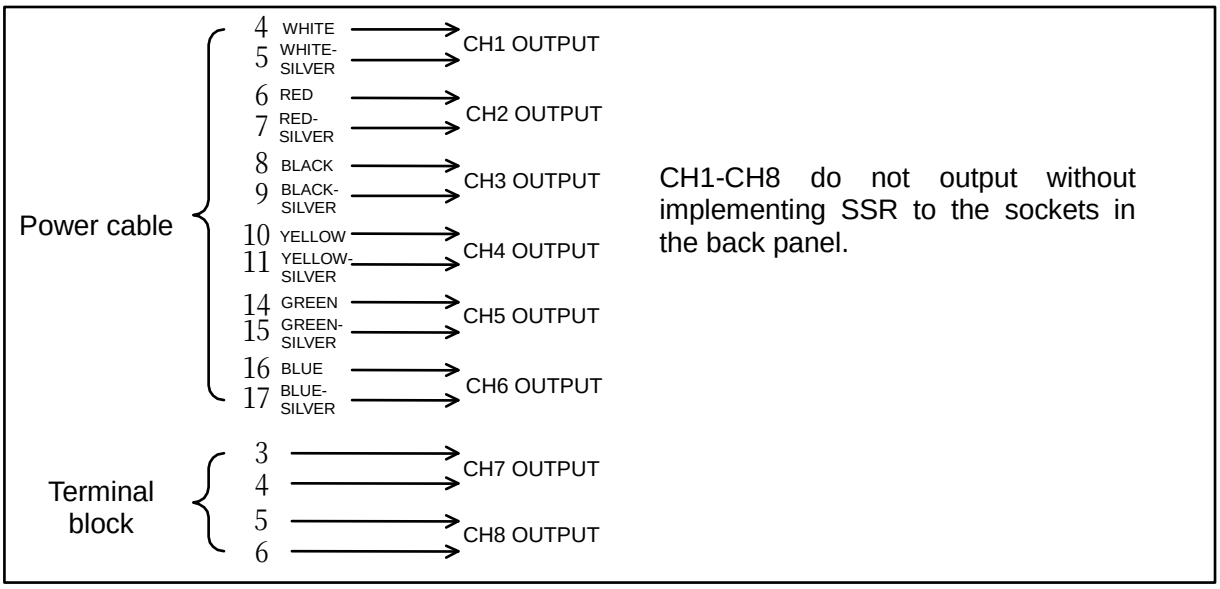
Take note of SSR's direction to be inserted or bending of the pin when inserting the SSRs.



5-3. Wiring SSR output

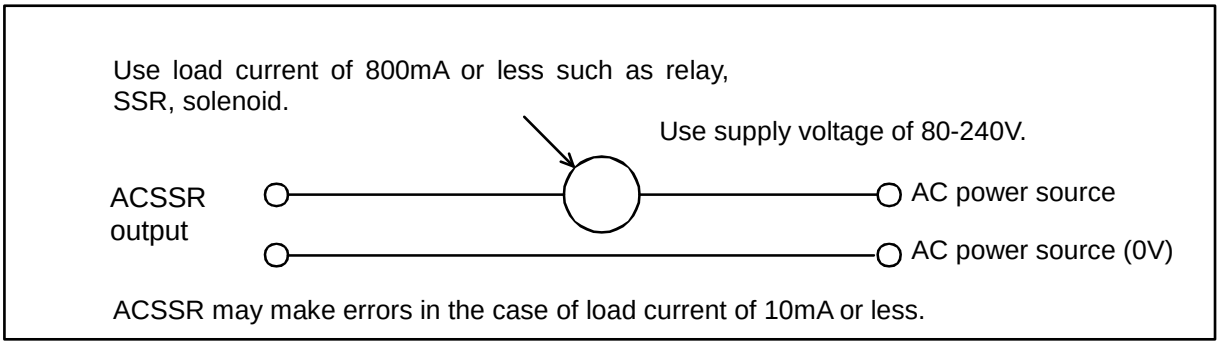
From cams 1 to 6 are connected to the power cable and cams 7 and 8 are to the terminal block.

The cams 1 to 8 do not output without inserting the SSRs.



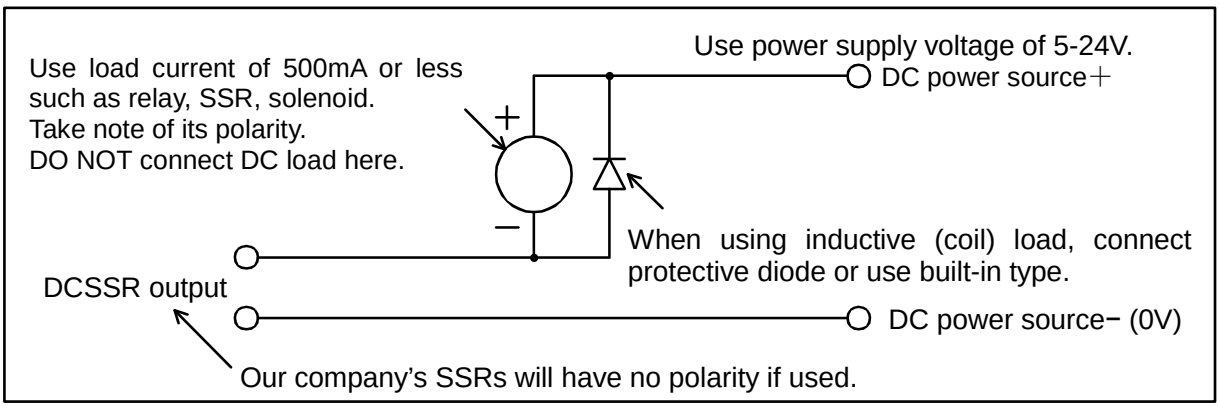
5-3-1. Connection of AC load

The AC load such as relay and solenoid should be connected to the ACSSR output. Outputting of the ACSSR is from 80 to 240V, 10 to 800mA or less. If ACSSR is used in DC circuit, the output remains ON.



5-3-2. Connection of DC load

The DC load such as relay and solenoid should be connected to the DCSSR output. Outputting of the DCSSR is from 5 to 24 V, 500mA or less. To connect an inductive (coil) load, be sure to connect a protective diode. If the SSRs by Sugiyama Electric System inc. are used, they will have no polarity at the output.

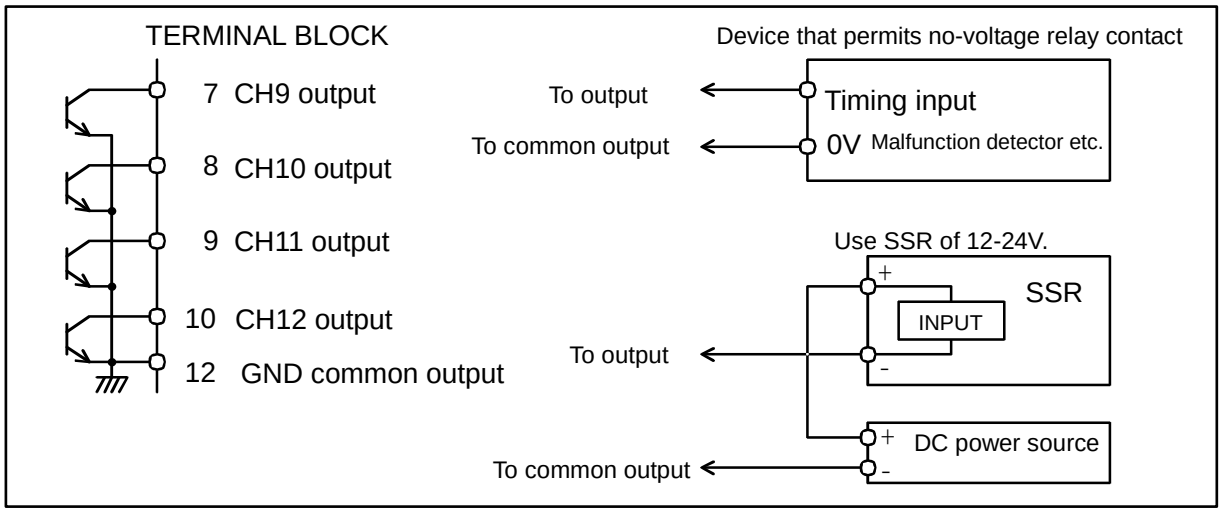


5-4. Open collector output

Outputting from cams 9 to 12 are connected to the terminal block as an output of open collector. An emitter of the output transistors is connected to a GND terminal of the terminal block.

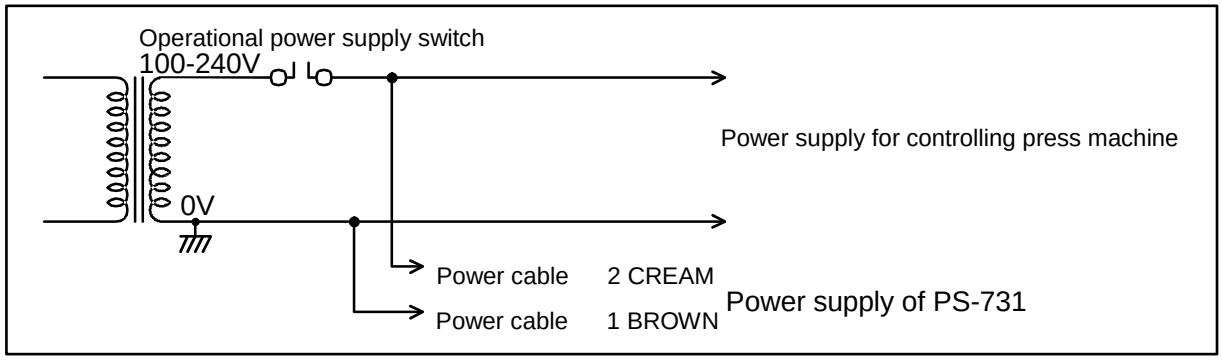
Use an open collector output from 5 to 24V, 100mA or less.

As for the wiring to be connected to the open collector output, keep it clear of the power line or shielding on it.



5-5. Connecting power sources

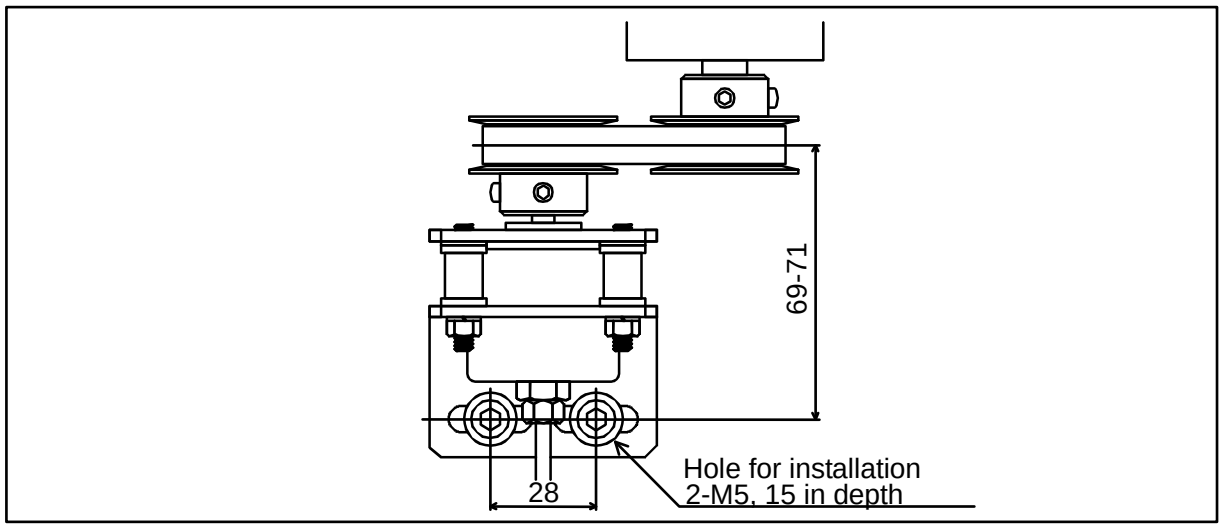
Connect the power source (AC100V) of the press machine to the brown and cream power cables.



5-6. Installing rotary encoder

To detect rotation via a timing belt, install pulleys to revolution shafts of the rotary encoder and the press machine. Adjust the position of the pulleys so that the timing belt can be on the center at the time of revolution.

Select a proper timing belt to keep as short as possible distance from the pulley. Stretch the timing belt with proper tension, preventing the timing belt from detaching.



5-7. Connecting rotary encoder to control box

Connect the rotary encoder to the digital cam by an encoder junction cable. Keep the encoder junction cable away from power lines and secure it. Select the cable as short as possible.

5-8. Setting revolution direction of rotary encoder

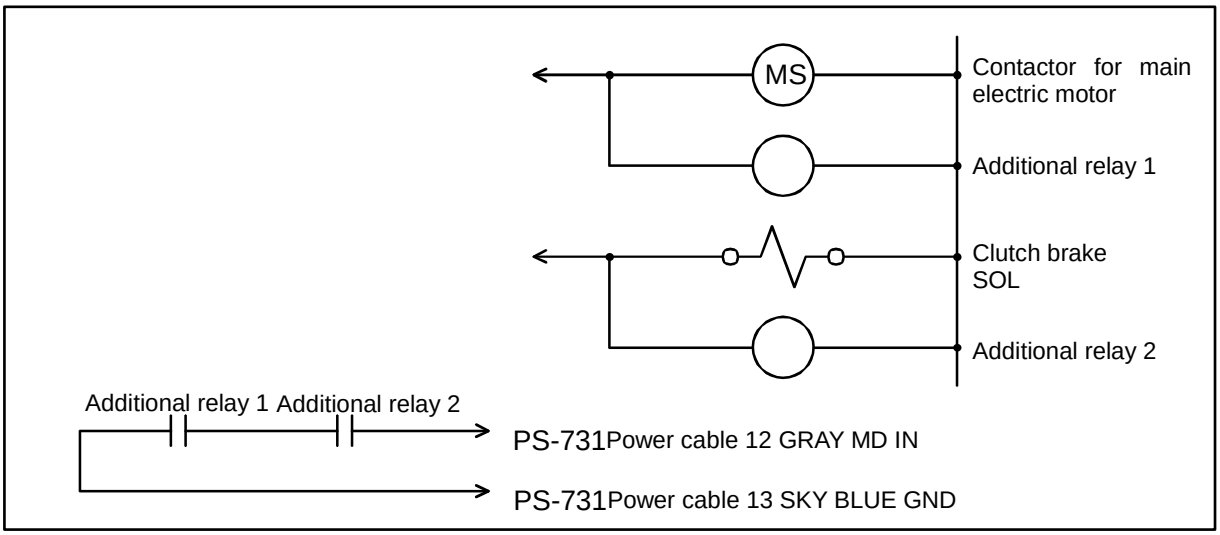
Check that the angle is increasing on the DEG/SPM display when turning the power source on and operating the press machine. If the angle is decreasing, change the setting of the encoder's revolution direction by the device setting (item number 12).

5-9. Angle adjustment of rotary encoder

Turn the power source of PS-731 on and stop the press machine at the T.D.C. after 2 strokes. Loosen up the setscrew of the pulley on the press to show 0 degree on the DEG display by turning the pulley on the press machine. After that, fasten the setscrew of the pulley. If you cannot turn the pulley on the press, adjust it by the device setting (item number 11) .

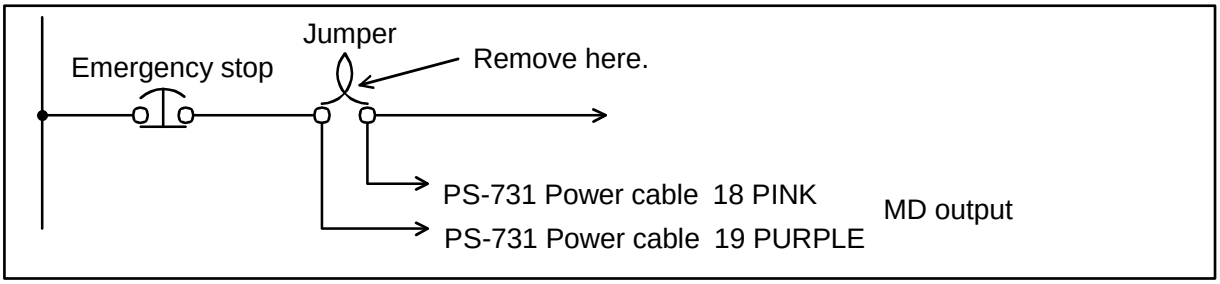
5-10. Connecting MD Input

The normal method of wiring the MD input is to connect a main electric motor start signal of the press machine in the control circuit to a clutch brake actuating signal. Connect relay coils in parallel to the contactor of the main motor and the clutch brake solenoid. PS-731 can operate without wiring the MD input.



5-11. Connecting MD output

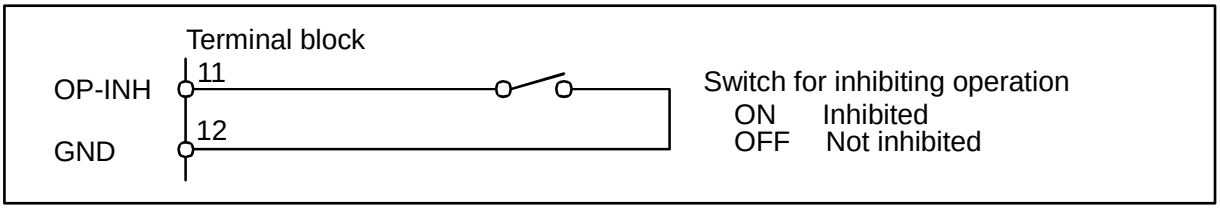
Connect the MD output to the emergency stop circuit of the press machine. Connect a pink or purple of the power cable. PS-731 can operate without wiring the MD output.



5-12. Connecting operation inhibition input

When the operation inhibition input is connected to the GND terminal, the operation is inhibited; when it is open, the operation is allowed.

PS-731 can operate without connecting the operation inhibition input.



5-13. Device settings

Change settings such as cam output polarity, the fixed cam width, according to your usage.

6. Error display

When an error is detected, the error number appears and blinks on the DEG/SPM display. MD output is turned on.
"Exx" is displayed on the display when an error occurs. "xx" is numeric numbers of 2-digit. Push the CANCEL button to release an error. When several errors occur simultaneously, push the button for the number of times you need. If the error display disappears, the MD output will be turned to off.

6-1. Encoder start error E01
"E01" is shown on the display when a revolution signal from the rotary encoder is not detected within the encoder start time after the MD input is turned on.

6-2. Encoder 1 cycle MAX time error E02
After turning on the MD input and passing the encoder start time, "E02" is displayed if the rotary encoder 1 cycle time is more than encoder 1 cycle MAX time.

6-3. SPM down limit error E03
"E03" indicates that the present SPM is less than the present SPM×encoder 1 cycle MAX time ÷100.

6-4. Backup error E04
"E04" represents that the built-in battery becomes low. The present angle is 0.

6-5. Encoder AB error E05
"E05" represents that a signal from the encoder is not normal.

6-6. Encoder Z error E06
"E06" represents that a signal from the encoder is not normal.

6-7. System memory error E07
"E07" represents that the system setting value fails to be read properly.

6-8. Spare E08
"E08" error does not occur. This is a spare item for changing the program.

6-9. Pattern memory error E09
"E09" appears on the display when it fails to read settings properly at the time of recalling a pattern.

6-10. Memory store error E10

“E10” appears on the display when it fails to store settings properly at the time of storing a pattern.

6-11. Instant power failure error E11

“E11” represents that the power becomes low instantly.

6-12. Common advance angle time memory error E12

“E12” appears on the display when it fails to read settings properly at the time of turning the power on or recalling a pattern.

7. Device setting

7-1. Setting mode

You can change cam angle adjustment, functional settings except for control methods, and device settings of PS-731. Switch the normal mode to the setting mode before changing the device settings.

7-1-1. Switching to setting mode

Push the CAM DISPLAY/CANCEL button, holding down the FUNCTION button to switch to the setting mode. When turning to the setting mode, a stop signal is output from the MD output.
On the pattern number display, the previous number before switching to the setting mode is displayed. An item number is shown on the DEG/SPM display. Setting values are displayed on the CAM NUMBER display, the ON/OFF number display.
All LED lamps except the roulette display go off.

7-1-2. Selecting of item number

Turn the rotary knob and select the item number while it is blinking. When the item number that you can set or change is displayed, corresponding setting values appear on the digital displays. If its setting or changing is not allowed, nothing appears on the digital displays.
90s' item numbers are for system operations, not device settings.

7-1-3. Change of setting value

After selecting an item number, push the ON button or the TEACH button to transfer blinking over setting values and change the blinking values.
When you set 0/1 or A/b for each cam number, a cam number is on the CAM NUMBER display and a setting value is on the ON display respectively. Change the cam number by the rotary knob and the setting value by the ON button respectively.
As for the case where the cam number is not shown, you can change its setting value by turning the rotary knob. If setting values are 0/1 or A/b, you can change by the ON button.
Item numbers 94-99 are for system operations and their operating instructions are not the same. Follow the instructions for each item number.
After selecting the desired value, push the TEACH button and the setting ends.
When interrupting the setting, push the CANCEL button. The blinking value will be returned to the value before settings and then it stops blinking.

7-1-4. End the setting mode

To end the setting mode, push the FUNCTION button or the CAM DISPLAY/CANCEL button while an item number is blinking. After that, it will come back to the normal operation.
When pushing the FUNCTION button, the settings are stored in memory. When pushing the CAM DISPLAY/CANCEL button, it returns to the previous value without storing them in memory.

7-1-5. Display of program version

Select the item number 0 in the setting mode to show the program version number in the OFF number display. Functions might be partially altered depending on the program version.

7-2. Details of settings

7-2-1. Item number 1 common cam

Used to select pattern cam or common cam for each cam number. You can select “0” or “1” for the setting value. “0” is for a pattern cam; “1” is for a common cam. All the initial values are set to be pattern cams.

7-2-2. Item number 2 fixed cam width

Used to select fixed or non-fixed cam width setting for each cam number. You can select “0” or “1” for the setting value. “0” is selected for non-fixed cam width setting; “1” is for fixed cam width. The initial value for all the cams are set to be non-fixed.

7-2-3. Item number 3 output polarity

Sets output polarity for each cam number. The setting value is “A” or “b”. “A” is Normally Open; “b” is Normally Close. The initial values for all the cams are “A”.

7-2-4. Item number 4 setting prohibited cam

Sets whether setting change is permitted or prohibited. You can select “0” or “1” for the setting value. When “0” is selected, you are allowed to change settings; when “1” is selected, you are not allowed to change them. In initial settings, setting change of all cams is permitted.

7-2-5. Item number 5 encoder starting check time

Sets the maximum time until the rotary encoder starts to rotate after the MD input has been turned on. You can set the time of 0-999. The initial value is 100mS.

7-2-6. Item number 6 encoder 1 cycle MAX time

This item is the maximum time for the rotary encoder to rotate by 1 cycle. You can set the time of 0-999mS. The initial value is 100mS.

7-2-7. Item number 7 MD Input polarity

You can set “A” or “b”. “A” is Normally Open and “b” is Normally Close. The initial value is “A”.

7-2-8. Item number 8 MD output polarity

You can set “A” or “b”. “A” is Normally Open and “b” is Normally Close. The initial value is “b”.

7-2-9. Item number 9 advanced angle with MD

Interrupts the automatic advance angle system in relation to a stop of the rotary encoder's revolution when the MD input signal is turned off. You can set "0" or "1". "0" is unrelated; "1" is related. The initial value is 0 (unrelated). Make sure to connect the MD input to a clutch signal of the press machine when you select advance angle with MD. Otherwise, automatic advance angle system does not work or an error occurs.

7-2-10. Item number 10 MD output under pattern operation

Used to determine whether the MD output is related or unrelated to recalling/storing pattern. If "0" is set, it is unrelated. If "1" is set, it is related. The initial value is 1(related).

7-2-11. Item number 11 angle change of DEG display

When this item is selected, the present angle on the DEG display is shown on the ON number display; the present encoder angle is on the OFF number display. You can set 0-359°. In the initial setting, both the angle on the DEG display and encoder angle are the same. Configure the setting while the rotary encoder's revolution is interrupted.

7-2-12. Item number 12 encoder revolution direction

Sets the revolution direction of the rotary encoder when the angle is increasing on the display. You can set "0" or "1". "0" is set when turning the shaft clockwise from the shaft side of the rotary encoder; "1" is set when turning counter-clockwise. The initial value is "0".

7-2-13. Item number 13 encoder angle error limit

Sets an allowable gap of the rotary encoder's angle. You can set 0-99°. The initial value is 5°.

7-2-14. Item number 14 encoder hysteresis angle

This item is the range of the angle that will not change output if the rotary encoder is turning reversely. You can set 1-16°. The initial value is 3°.

7-2-15. Item number 15 numeric display of advance angle

This setting is for the cam for which the automatic advance angle has been set. The advance angles for the cam are shown on the ON/OFF setting angle displays. You can set "0" or "1". If "0" is selected, it is not displayed. If "1" is selected, it is displayed. The initial value is 1(displayed).

When the display turns to show the advance angle, a decimal point appears on the ON/OFF setting angle displays.

7-2-16. Item number 16 roulette display of advance angle

This setting is also for the cams for which the automatic advance angle has been set. If selecting the cam width, the advance angle for the cam is shown on the roulette display. You can set “0” or “1”. If “0” is selected, the advance angle cam is not displayed. If “1” is selected, it is displayed. The initial value is 1(displayed).

7-2-17. Item number 17 roulette display of angle and cam angle

Used to determine whether the angle and cam angle are displayed simultaneously on the roulette angle display or not. You can set “0” or “1”. If “0” is selected, it is not displayed simultaneously. If “1” is selected, it is displayed. The initial value is 1 (displayed) .

7-2-18. Item number 18 display of changed cam

A lower decimal digit appearing on the cam number means that the setting of the cam is changed. You can set “0” or “1”. When “0” is selected, it is not displayed. When “1” is selected, it is displayed. The initial value is 1(displayed).

7-2-19. Item number 19 display of common cam

A higher decimal digit appearing on the cam number means that common cams are set. You can set “0” or “1”. When “0” is selected, it is not displayed; when “1” is selected, it is displayed. The initial value is 1(displayed).

7-2-20. Item number 20 roulette display of timer output

Used to determine whether the timing of timer setting is displayed as output width on the roulette display or not. You can set “0” or “1”. If “0” is set, timer output is not displayed; if “1” is set, it is displayed. The initial value is 1(displayed).

7-2-21. Item number 21 immediate operation of angle setting

This setting is to enable output control even while changing the angle setting by the rotary knob. You can set “0” or “1”. When “0” is set, immediate operation of the angle setting is prohibited; when “1” is selected, it is allowed. The initial value is 0 (prohibited) . If this setting is allowed, by pushing the CANCEL button during the setting, the angle setting will end, not being canceled.

7-2-22. Item number 22 immediate operation of advance angle setting

This setting is to enable output control even while changing the advance angle setting by the rotary knob. You can set “0” or “1”. When “0” is set, immediate operation of the advanced angle setting is prohibited; when “1” is selected, it is allowed. The initial value is 0 (prohibited) .If the setting is allowed, by pushing the CANCEL button during the setting, the advanced angle setting will end, not being canceled.

7-2-23. Item number 23 immediate operation of timer setting

This setting is to enable output control even while changing the value of the timer setting by the rotary knob.

You can set “0” or “1”. If “0” is set, immediate operation of the advance angle setting is prohibited; if “1” is selected, it is allowed. The initial value is 0 (prohibited) . While the setting is valid, the setting will not be cancelled even by pushing the CANCEL button during the setting and then the setting ends.

7-2-24. Item number 24 SPM measuring start angle

You can set 0-359 ° for the SPM measuring start angle. The initial value is 30 ° . If 360 ° are set in item number 25 “SPM measuring angle”, this setting becomes invalid.

7-2-25. Item number 25 SPM measuring angle

You can set 1-360 ° by the steps of 1 degree for the SPM measuring angle. The initial value is 180 ° . If 360 ° are set, the setting of item number 24 “SPM measuring start angle” becomes invalid.

7-2-26. Item number 26 operating pattern NO. after power ON

Specifies which pattern will be copied to the present setting after power on. You can set 0-99. If other numbers than 0 are entered, the pattern number will be copied to the present setting after power on. If 0 is entered, the backuped setting value will be used in the present setting. However, provided that the backup error occurs, the pattern number 1 will be copied. The initial value is “0”.

7-2-27. Item number 27 stop checking time of encoder

Sets the maximum time of one cycle of the rotary encoder's revolution to check that the press machine stops. You can set 0-999mS. The initial value is 30mS.

7-2-28. Item number 28 revolution check angle of the press start

The automatic advance angle system starts after passing this check angle when the revolution restarts after interruption of the press machine. You can set 0-359 ° . The initial value is 30 ° .

7-2-29. Item number 29 setting inhibition input polarity

Sets inhibition input polarity. You can set “A” or “b”. “A” is close, “b” is open to prohibit. The initial value is “A”.

7-2-30. Item number 30 high speed change of rotary knob

Sets the clicking time for turning the rotary knob quickly. If your clicking time is shorter than the setting time, the value will be added or reduced by the up/down value (item number 31). The setting value is 0-99mS. The initial value is 20mS.

7-2-31. Item number 31 up/down value of rotary knob high speed

Sets the value to be added or reduced for when rotating the setting knob quickly. The values range 0-999. The initial value is 5.

7-2-32. Item number 32 SPM down limit

When comparing the present SPM with the last SPM (for one stroke earlier than the present stroke), a stop signal is output when it is less than this limit. You can set 0-99. The initial value is 0.

When the result of the following formula is negative, a stop signal is output.

Last SPM−present SPM× SPM down limit ÷100

7-3. System operation

When the system operation is executed, backuped data is deleted. Store the value of the present setting in pattern memory before executing the system operation.

7-3-1. Item number 93 common advance timing delete

Returns all the common advance timing to 0. After selecting an item number, push the ON button or the TEACH button. The ON display shows "-" and it starts to blink. When pushing the TEACH button, common advance timing is deleted and then "End" is displayed. Push the CANCEL button to interrupt the operations.

7-3-2. Item number 94 pattern copy

Transfers cam setting from an original pattern to a copied pattern. After selecting the item number, push the ON button or the TEACH button to show the pattern number of the original on the ON number display and that of the copied pattern on the OFF number display respectively, and then the number on the ON number display starts to blink. When pushing the ON or OFF buttons, the blinking is transferred over the corresponding display. You can change blinking numbers by turning the rotary knob. After setting the desired value, push the TEACH button to execute the copy. After completion of the copy, "End" is displayed on the ON number display. Push the CANCEL button to interrupt during the operation.

7-3-3. Item number 95 pattern full copy

Transfers cam setting from an original pattern to all the patterns. After selecting the item number, push the ON button or the TEACH button to display and blink the original pattern number on the ON number display. You can change blinking numbers by turning the rotary knob. After setting the desired value, push the TEACH button to execute copying. After the completion of the copy, "End" is displayed on the ON number display. Push the CANCEL button to interrupt during the operation.

7-3-4. Item number 96 pattern delete

Deletes the cam setting of the pattern you specify.

After selecting the item number, push the ON button or the TEACH button to display and blink the pattern delete number on the ON number display. You can change the blinking number by turning the rotary knob. After setting the desired value, push the TEACH button to execute delete operation. After the completion of deleting, “End” is displayed on the ON number display. Push the CANCEL button to interrupt during the operation.

7-3-5. Item number 97 pattern full delete

Deletes all the the cam settings of all the patterns.

After selecting the item number, push the ON button or the TEACH button to display and blink “-” on the ON number display. Push the TEACH button to execute pattern full delete operation and “End” is displayed. Push the CANCEL button to interrupt during the operation.

7-3-6. Item number 98 backup delete

Deletes the backuped data. When returning to the normal operation, a backup error occurs. After selecting the item number, push the ON or the TEACH button to display and blink “-” on the ON number display. Push the TEACH button to delete the backuped data and “End” is shown on the display. Push the CANCEL button to interrupt during the operation.

7-3-7. Item number 99 system reset

Sets initial values for the item numbers 1-33. After selecting the item number, push the ON or the TEACH button to display and blink “-” on the ON number display.

Push the TEACH button to initialize the system setting temporarily and display “End”. At this time, the system setting memory is not reset yet. To execute it, push the FUNCTION button. Then, when returning to the normal operation, the memory is reset. Push the CANCEL button to interrupt during the operation.

7-4. Item number list

Item NO.	Function	Setting value	Initial value/Note
00	program version	X.XX	
01	common cam	0/1	0=pattern cam 1=common cam
02	fixed cam width	0/1	0=non fixed 1=fixed
03	output polarity	A/b	A=NO b=NC
04	setting prohibited cam	0/1	0=permitted 1=prohibited
05	encoder starting check time	0-999mS	200mS
06	encoder 1 cycle MAX time	0-999mS	100mS
07	MD input polarity	A/b	A=NO b=NC
08	MD output polarity	A/b	A=NO b=NC
09	advanced angle with MD	0/1	0=unrelated 1=related
10	MD output under pattern operation	0/1	0=unrelated 1=related
11	angle change of DEG display	0-359 °	
12	encoder revolution direction	0/1	0=CW 1=CCW
13	encoder angle error limit	0-99 °	5 °
14	encoder hysteresis angle	0-16 °	3 °
15	numeric display of advance angle	0/1	0=non displayed 1=displayed
16	roulette display of advance angle	0/1	0=non displayed 1=displayed
17	roulette display of angle and cam angle	0/1	0=non displayed 1=displayed
18	display of changed cam	0/1	0=non displayed 1=displayed
19	display of common cam	0/1	0=non displayed 1=displayed
20	roulette display of timer output	0/1	0=non displayed 1=displayed
21	immediate operation of angle setting	0/1	0=prohibited 1=permitted
22	immediate operation of advance angle setting	0/1	0=prohibited 1=permitted
23	immediate operation of timer setting	0/1	0=prohibited 1=permitted
24	SPM measuring start angle	0-359 °	30 °
25	SPM measuring angle	0-359 °	180 °
26	operating pattern NO. after pattern number	0-99	0(0=backuped pattern)
27	stop checking time of encoder	0-999mS	30mS (max time encoder 1 degree)
28	revolution check angle of press start	0-359 °	30 °
29	setting inhibition input polarity	A/b	A=close b=open to prohibit
30	high speed change of rotary knob	0-99mS	20mS
31	up/down value of rotary knob high speed	0-99	5
32	SPM down limit	0-99%	0%
93	common advance timing delete		
94	pattern copy		
95	pattern full copy		
96	pattern delete		
97	pattern full delete		
98	backup delete		
99	system setting reset		

8. Specifications/performance

8-1. Control area

Angle detector	Incremental rotary encoder 360 steps/revolution
Maximum SPM	1500SPM
Cam channel	12
Cam output	CH1-8 Either AC or DC SSR CH9-12 Open collector
MD output	No voltage relay contact
Angle setting	0-359° 1° step
Automatic advance timing	0-999mS 1mS step
Max advance angle	360°
Timer setting	0-999mS 1mS step 1-9.99S 10mS step

8-2. Display, numeric value setting

Angle SPM display	3-digit
Roulette display	10° step 36 points
Output display	12 points
Pattern number	2-digit
Cam number	2-digit
Setting angle	3-digit
Number setting method	Pulser (Manual rotary encoder)

8-3. Output

Open collector

Maximum voltage	30VDC
Minimum voltage	10VDC
Maximum output current	100mA
Output ON voltage drop	1.8V or less

Relay output

Max voltage	250VAC 30VDC
Max output current	2.0A (in the inductive load)

ACSSR

Max voltage	250VAC
Minimum voltage	75VAC
Max output current	1.0A
Output ON voltage drop	1.6V or below

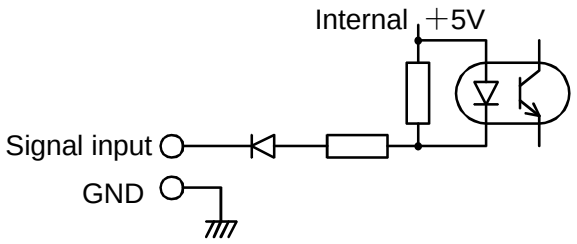
DCSSR

Max voltage	30VDC
Minimum voltage	5VDC
Max output current	0.5A
Output ON voltage drop	0.5V or below

8-4. Input circuits (MD input, operation inhibition input)

Input specification	Internal energizing voltage (DC5V)
H level	3.0 V or over 1mA or below
L level	1.0 V or over 8mA or below (10mA MAX)
	Use no-voltage contact or semiconductor switch

Input circuit



8-5. Power sources

Power source voltage	AC100-220V±10% 50/60Hz
Consumed electricity	15VA MAX

8-6. Rotary encoder

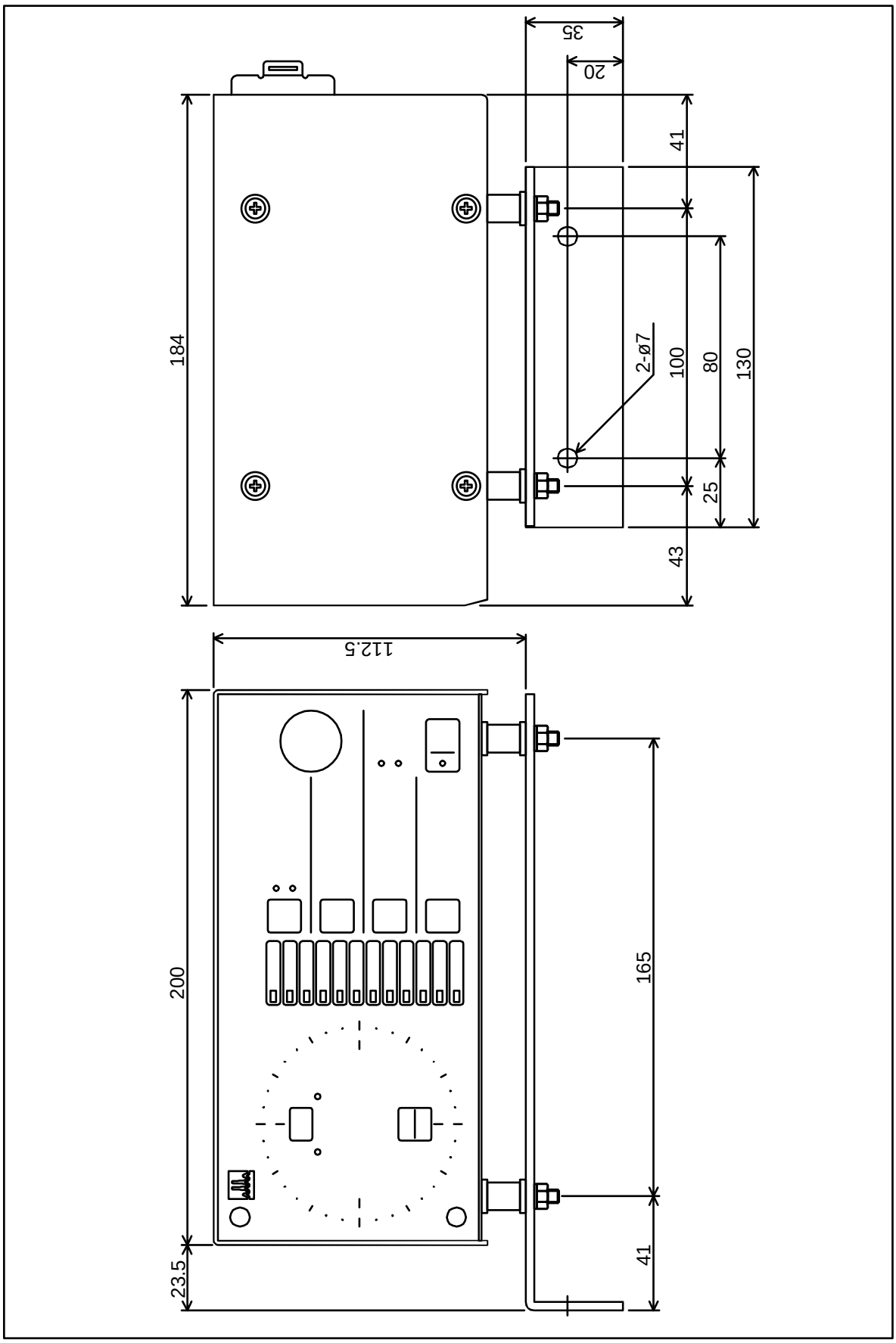
Allowable shaft load	Radial 1kg Thrust 0.5kg

8-7. Others

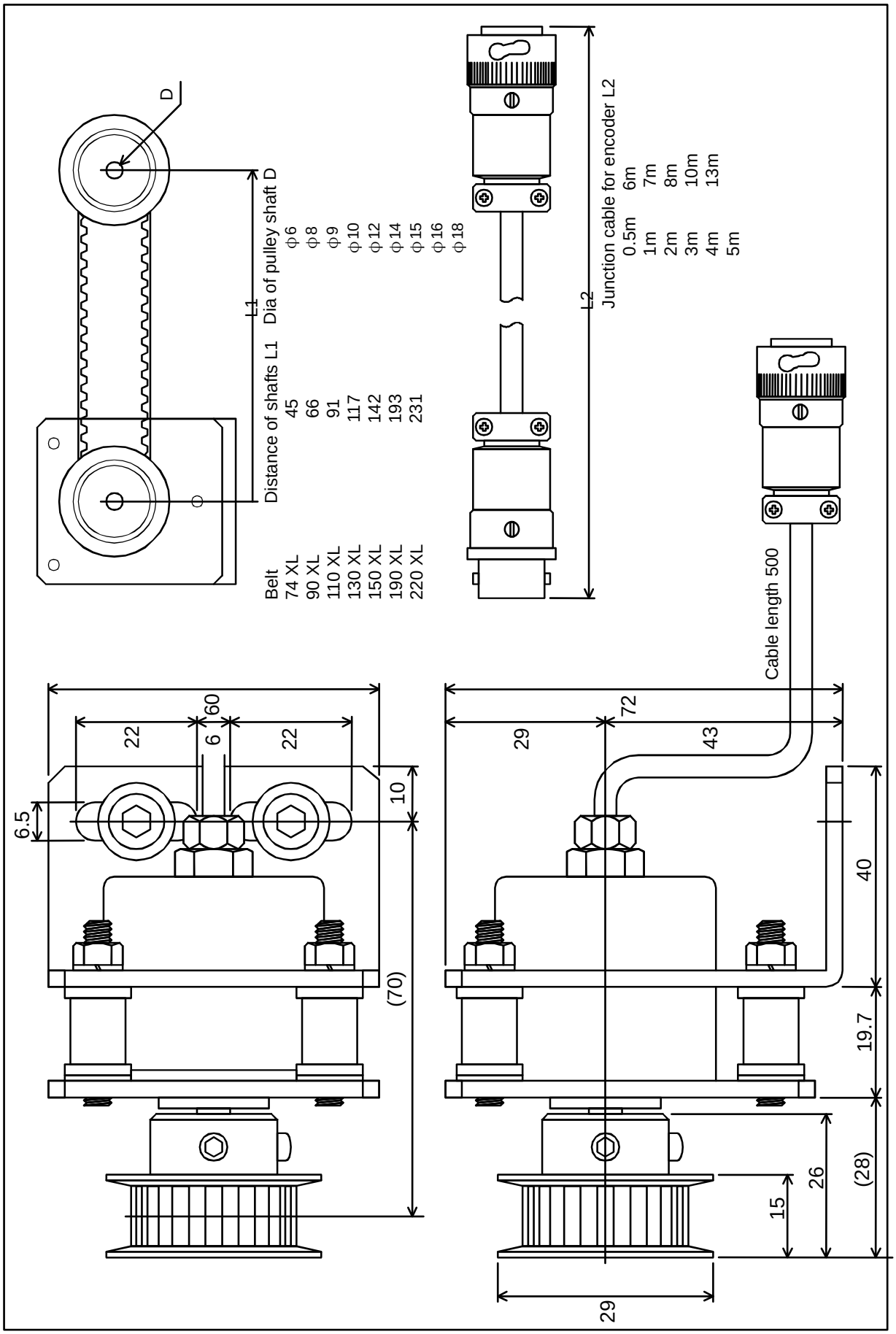
Weight	2.4kg
Dimensions(WHD)	200×98.5×184 Exclude protrusion.
Environment temperature	0-55℃
Environment humidity	35-85%
Environment atmosphere	Corrosive gas and dust should not exist.

9. Dimensions

9-1. Control box



9-2. Rotary encoder



WARRANTY

All Sugiyama Electric System products are warranted against defective materials and workmanship for one year from the date of delivery. Any questions with respect to the warranty should be taken up with your Sugiyama Electric System Field Engineer or agents.

All requests for repairs and replacement parts should be directed to the Sugiyama Electric System Office or agents in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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