INSTRUCTION MANUAL

DPS CONTROLLER

MODEL CM01-DPS

KIKUSUI ELECTRONICS CORPORATION

TABLE OF CONTENTS

1. GENERAL

Model CM01-DPS DPS Controller is a programmable controller designed for control of Kikusui DPS (Digital Programmable Power Sources).

This instrument sequentially delivers the data which has been written in this instrument. Data which can be written in this instrument are general data including polarity, and ranges, addresses, and hold time per one step when in continuous control operation. Up to 64 items of data can be stored. Flags also can be inserted for cycle start, cycle end, hold, and skip.

Data can be written by entering it with digital switches and toggle switches and depressing the strobe key.

Data can be written in either one of the two modes--one is to write data and flag at the same time and the other is to write flags only. Data can be written simply by loading program step numbers, setting the switches in the required positions and depressing the strobe key. Program steps are automatically updated and the written data is indicated on the display unit.

Data can be read also in one of the two modes--one is the step mode that steps are updated each time the strobe key is pressed and the other is the continuous mode that steps are continuously updated on the programmed time schedule.

A manual mode also is possible. When in this mode, DPS can be directly controlled with switches without using memory.

Memory is involatile and information stored in it is not destroyed even when the instrument power is turned off.

This instrument has a D/A converter which delivers a DC voltage of ±(0 - 9.999) V with 1 mV resolution. Due to this provision, the instrument can be used also as a function generator.

2. SPECIFICATIONS

Instrument name: DPS Controller

Model number: CM01-DPS

Control section

Modes

WRITE: FLAG & DATA

FLAG (writing of flags only)

READ: STEP (manual)

CONT (continuous)

Types of read: ⋀⋁(both-direction read)

⋀(single-direction read)

MANUAL: Directly controlled with panel control switches

Data

	Setting	Display	Output	Fan-out
DATA	Digital switches 0 - 9999	7-segment LEDs	TTL level, 16 bits, BCD, negative logic	15
POL	Digital switches +, -	LED	TTL level, 1 bit, H:+, L:-	15
RANGE	Digital switches 4 ranges (0 - 3)	7-segment LEDs	TTL level, 2 bit, BIN, negative logic	15
ADDRESS	Digital switches, 16 addresses (0 - 15)	7-segment LEDs	TTL level, 4 bit, BIN, negative logic	15
STANDBY	Toggle switch	LED	TTL level, 1 bit, H: STANDBY on L: STANDBY off	15
TIME (step hold time)	Digital switches 001 - 999	7-segment LEDs		

Program steps: 64 (0 - 63) steps
Setting: Digital switches
Step load switch provided

Time accuracy: ±(0.05% of set value + 50 μsec),
all ranges

Flags

START: Toggle switch setting, LED display

END: Toggle switch setting, LED display

HOLD: Toggle switch setting, LED display

SKIP: Toggle switch setting, LED display

Time ranges: 1 msec, 10 msec, 100 msec, 1sec, 10 sec;
rotary switch setting

Strobe

WRITE mode: Write strobe

READ mode, STEP: Step advance strobe

CONT: Start strobe

MANUAL mode: DPS direct write strobe, output pulse
width approx. 10 μsec.

All of these modes cannot be effected unless BUSY lamp is off.

Operation: ON/OFF operation

When off

Digital output signal: TTL "H" level

DC output voltage: Mechanical open

RESET function: Resetting of all circuits except memory

DIRECT operation: Operation irrespective of mode setting

SET: Pushbutton setting

DATA CREAR: Pushbutton setting

STANDBY: Toggle switch setting

ZERO: Toggle switch setting

Output: Contact signal, negative logic.
When "0", pulled up with 10 kΩ

ALARM lamps: TTL level input

READY: On with "H" level

OVERLOAD: On with "L" level

THERMAL DOWN: On with "L" level

ADDRESS: On with "H" level

DATA, RANGE: Either one is on with "L" level

DC voltage output section

Output voltage: ±(0 - 9.999) V

Resolution: 1 mV

Setting accuracy: ±(0.05% of set value + 500 μV), at 25°C (77°F)

Ripple and noise: Not greater than 300 μV rms, at 10 Hz - 1 MHz

Load regulation: Better than 500 μV, for 0 - 100% load change

Line voltage regulation: Better than 500 μV, for ±10% line voltage change

Response speed: Faster than 500 μsec for maximum negative voltage to maximum positive voltage change

Output current: 10 mA maximum

Ambient temperature range: 0°C to 40°C (37°F to 104°F)

Power requirements: 100 V, 50/60 Hz AC, approx. 48 VA (when full DC voltage output load)

Dimensions:	210 W × 140 H × 420 D mm (8.27 W × 5.51 H × 16.54 D in.)
Maximum dimensions:	221 W × 152 H × 465 D mm (8.70 W × 5.98 H × 18.31 D in.)
Weight:	Approx. 7.6 kg (17 lbs.)
Accessories:	Instruction manual Cable, 1.5 m (4.9 ft), with Amphenol connector (50P)

3. OPERATION METHOD

3.1 Explanation of Front Panel (Figure 3-1)

① POWER: Main power on/off switch

② DATA: Digital switches for data setting for 0 - 9999. When setting data, pay attention to range and data columns of DPS unit to be controlled with this instrument.

③ POL: Digital switch for setting of polarity of data.

④ RANGE: Digital switches for range setting, as shown in the following table:

Setting	R (DPS range)
0 4 8	$R \leq 1$
1 5 9	$1 < R \leq 10$
2 6	$10 < R \leq 100$
3 7	$100 < R \leq 1000$

Note: Values may vary depending on DPS unit. See the instruction manual of the DPS unit to be controlled.

⑤ ADDRESS: Digital switches for address setting for 0 - 15 addresses. Although setting can be done up to 99, note that 16 and further addresses are invalid.

⑥ TIME: Digital switches for setting of hold time of data read step for 001 - 999. Time can be set for each step to hold data, as is the case for data setting.

⑦ STANDBY: Control switch for STANDBY operation. The STANDBY position is for STANDBY on. In this case, DC voltage output is mechanical open.

⑧ FLAG: When one of these switches is set in the "1" position, flag is written in memory and corresponding LED turns on. For details, see Subsection 3.10.

START: To specify read start step.

END: To specify read end step.

HOLD: To halt continuous read operation and hold in this state until the next start strobe is applied.

SKIP: Data of step for which this command is set is not delivered and operation advances to the next step.

⑨ STEP: Digital switches for step setting for 0 - 63. Although setting can be done up to 99, note that 64 and further steps are invalid.

⑩ LOAD: This switch is to call steps set with STEP switches ⑨. When thrown to the upper position, switch is locked and held in this LOAD state. During the period the switch is pressed to the lower position, it is held in the LOAD state, but as you release it, it bounces back and the LOAD state is released.

⑪ BUSY: This LED lights to indicate that the circuit is being accessed and writing of data into this instrument is inhibited.

⑫ RESET: When this pushbutton switch is pressed, all circuits (except memory) are reset.

⑬ TIME RANGE: This switch selects data read step hold time range. It can be turned with screwdriver (-). Although it can be set in other positions than those marked, such setting is invalid. Time range set by this selector switch is not stored in memory.

⑭ STROBE

WRITE mode: Strobe for writing in memory the data set with ② - ⑨.

READ mode, STEP: Strobe for step-by-step read

CONT: Strobe for continuous read

MANUAL mode: Strobe for writing data directly in DPS, with pulse signal of approx. 10 μsec.

Of all strobe signals, the function is effected when this button is pressed and released.

⑮ MODE: This rotary switch selects operation mode.

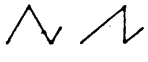
WRITE - FLAG & DATA: Write mode of ② DATA, ③ POL, ④ RANGE, ⑤ ADDRESS, ⑥ TIME, ⑦ STANDBY and ⑧ FLAG.

WRITE - FLAG: Write mode of ⑧ FLAG only; under the state that contents of ② DATA and others being held.

READ - STEP: Step by step read mode, data is delivered in the 1-step/1-strobe with ⑭ STROBE key relationship illespective of time setting.

READ - CONT: Continuous read mode. As ⑭ STROBE is pressed and released, read operation starts as instructed by commands of ⑧ FLAG.

MANUAL: Data and commands set with ② through ⑤ and ⑦ are directly delivered without using memory. Writing in DPS is effected at the instant ⑭ STROBE is pressed and released.

⑯  To select type of read when in ⑮ READ mode.

 Both-direction read

 Single-direction read

⑰ OPERATION: When set in the OPERATION (ON) position, data is read and delivered through rear terminal.

When set in the OFF position, all output lines become "H" level and the DPS becomes STANDBY state. The DC voltage output becomes mechanical open.

⑱ Display unit: Displays written data when in WRITE mode or read data when in READ mode.

Switches ⑲ and ⑳ have been incorporated specifically for control of Kikusui DPS units.

⑲ DIRECT: With these switches, commands are set for all DPS units connected to this instrument, irrespective of setting of ⑤ ADDRESS.

SET: This switch is pressed and set to turn on DPS power. Once it has been set, the status does not change even when it is pressed again.

STANDBY: When this switch is set in the "1" state, the DPS output becomes mechanical open. The DC voltage output of this instrument also becomes mechanical open.

ZERO: During the period this switch is held in the "1" state, the DPS output becomes electrical zero while protecting the contents of DPS register. When this switch is released, the original status is restored.

DATA CLEAR: To clear the contents of DPS register.

ZERO and DATA CLEAR functions cannot be used for DC voltage output section of this instrument.

⑳ ALARM: These lamps light or goes off when an abnormal state is caused in any one of the DPS units connected to this instrument.

THERMAL DOWN: This lamp turns on when DPS temperature has become abnormally high and internal thermal relay has tripped.

OVERLOAD: This lamp turns on to indicate overload of DPS output.

ADDRESS/DATA/RANGE: Corresponding lamp turns on to indicate an abnormal state for the command.

ADDRESS: Turns on when there is no DPS corresponding to the set address.

DATA: Turns on when set data has exceeded the limit value of DPS specified by the address.

RANGE: Turns on when there is no corresponding range in the specified DPS.

READY: When this LED lamp is on, the instrument is in the READY state and data can be written in the DPS.

3.2 Explanation of Rear Panel

(See Figure 3.2)

(21) OUTPUT: Connector (Amphenol, 50 pins) for digital output signal of this instrument. Pin numbers are as shown in Sub-section 3.3.

(22) OUTPUT: 0 ±10V DC voltage output terminal which delivers an output voltage of ±(0 - 9.999) V with 1-mV resolution. Red binding post is positive or negative terminal with respect to white binding post which is connected to signal ground.

The output is mechanical open when in STANDBY ON, DIRECT STANDBY ON or OPERATION OFF.

For this DC voltage output section, specification functions of (5) ADDRESS and (4) RANGE with the control section of this instrument are ineffective.

(23) LED: With this switch the LED lamps of the display section on the front panel can be turned off when they are not required in such case as fast speed read.

(24) Fan motor: Ventilation fan motor

(25) FUSE: AC line power fuse, 1 A (slow blow type), tubular glass

㉖ Power cord: AC power cord (to be connected to a 100 V, 50/60 Hz AC line outlet)

3.3 Pin Numbers of Output Connector

1	STROBE	26	1 (LSD)
2		27	2 (LSD)
3		28	4 (LSD)
4		29	8 (LSD)
5		30	1 (DATA)
6		31	2 (DATA)
7		32	4 (DATA)
8	STANDBY	33	8 (DATA)
9		34	1 (DATA)
10		35	2 (DATA)
11		36	4 (DATA)
12		37	8 (DATA)
13		38	1 (MSD)
14	DATA CLEAR	39	2 (MSD)
15	DIRECT STANDBY	40	4 (MSD)
16	DIRECT ZERO	41	8 (MSD)
17	2^0 (RANGE)	42	THERMAL DOWN
18	2^1 (RANGE)	43	
19	2^0 (ADDRESS)	44	2^2 (ADDRESS)
20	2^1 (ADDRESS)	45	2^3 (ADDRESS)
21	OVER LOAD	46	POLARITY
22		47	ERROR
23		48	READY
24	ADDRESS COINCIDENCE	49	SET
25	GND	50	GND

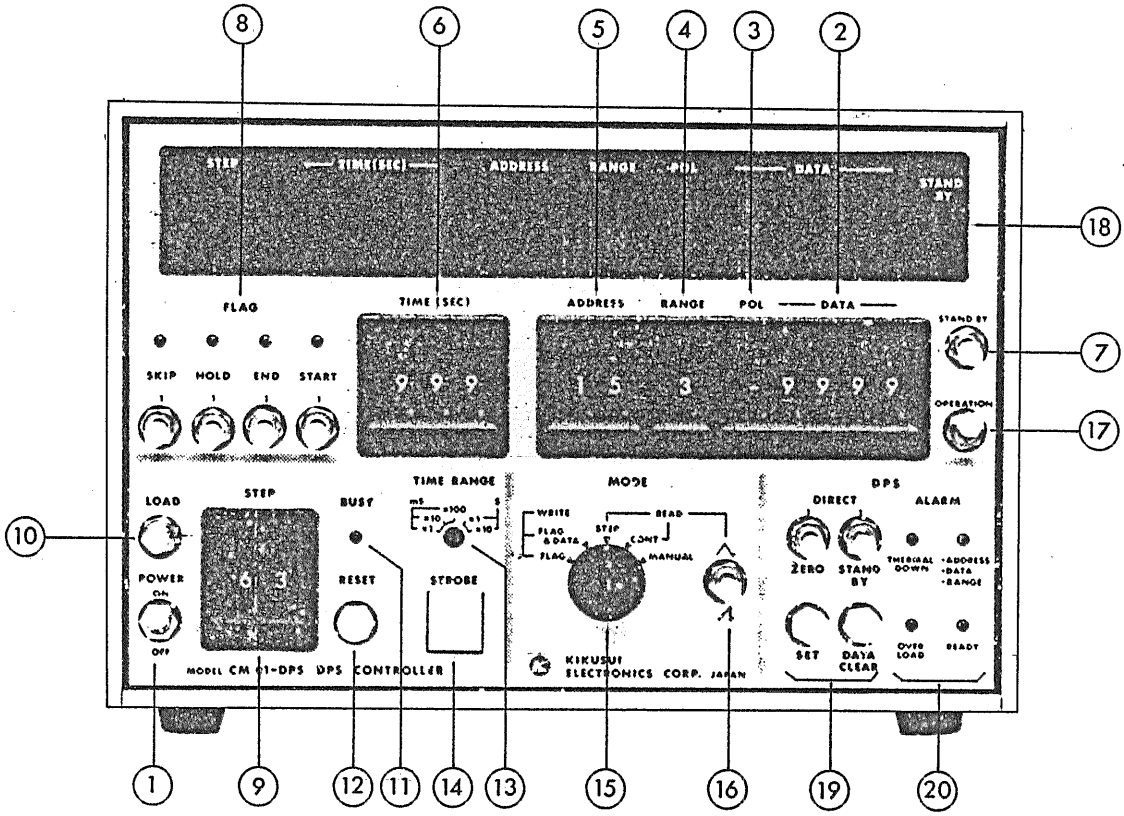


Figure 3-1. Front Panel

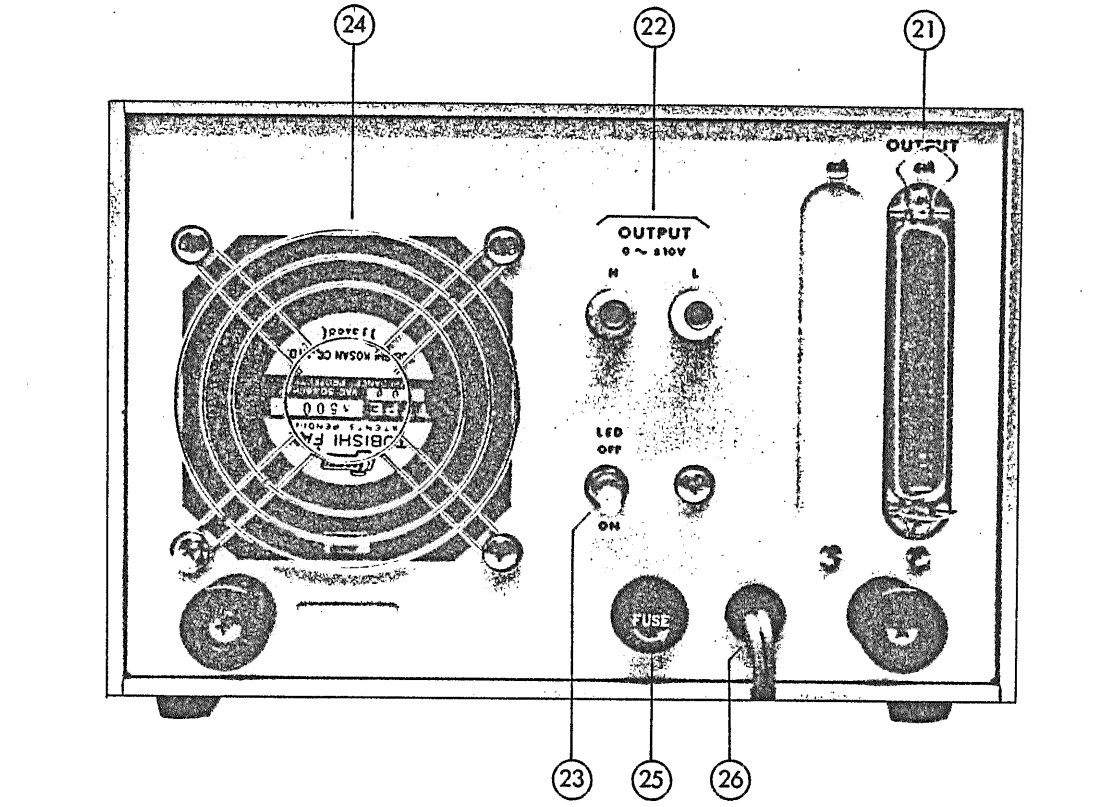


Figure 3-2. Rear Panel

3.4 Precautions Before Use

3.4.1 This instrument operates on a 100 V, 50/60 Hz AC power. Before connecting the instrument power cord to an AC outlet, make it sure that it meets these voltage and frequency requirements.

3.4.2 Do not use the instrument at a temperature beyond the specified ambient temperature limits or in a strong magnetic field.

3.5 Notes When Using the Instrument

3.5.1 This instrument employs core memory. Data stored in this involatile memory is not destroyed even when the instrument power is turned off. This, however, does not apply when the power is interrupted for a very short period (such as several seconds) which may cause erroneous circuit operation.

3.5.2 The instrument has been designed primarily for control of Kikusui DPS units. Although the instrument can be used for other purposes also, due attention must be paid in such applications.

3.5.3 The DPS control output signal levels are TTL level or contact signal. Note that, if the load is larger than the specified limit, the required output level may not be obtained and errors may result.

3.5.4 The instrument has been designed with protective features against external noise. However, to make it double sure that the instrument operates stably, operate it at a place where is free from noise. Also note that the instrument is not utterly free from generating noise.

3.5.5 Although up to 9 can be set with (4) RANGE setting digital switches, the effective range is 0 - 3. For 4 and further ranges, see the table of (4) RANGE of Sub-section 3.1.

3.5.6 Although up to 99 can be set with (5) ADDRESS setting digital switches, the effective range is 0 - 15. For 16 and further addresses, see the following table.

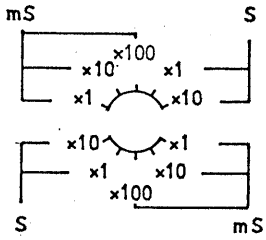
Setting						Address
16	32	48	64	80	96	0
17	33	49	65	81	97	1
18	34	50	66	82	98	2
19	35	51	67	83	99	3
⋮	⋮	⋮	⋮	⋮		⋮
30	46	62	78	94		14
31	47	63	79	95		15

3.5.7 Although up to 99 can be set with (9) STEP setting digital switches, the effective range is 0 - 63. The 64 and further steps are as shown in the following table. It is recommended to use the range of 0 - 63.

Setting	Step
64	0
65	1
⋮	⋮
99	35

3.5.8 (13) TIME RANGE selector switch can be set also in other positions than those marked on the front panel. The ranges at such unindicated positions are as shown below. Data

of (13) TIME RANGE cannot be stored in memory. Hold time with (6) TIME switches can be set for a range of 1 - 999 in one range. However, it cannot be set for different ranges, such as certain steps are with ×10 mS range and others are with ×1 S range.



3.6 Notes Regarding Instrument Operation

3.6.1 When in (15) WRITE (FLAG & DATA) mode and (17) OPERATION switch is "ON", the data which has been entered is delivered to the output connector as (14) STROBE key is depressed and released.

3.6.2 Operations of (19) DIRECT switches and (20) ALARM lamps are independent of setting of (15) MODE and (17) OPERATION switches.

When turning on the power of the DPS unit which has the STANDBY function, press (19) SET switch before operating the instrument.

The commands set by (19) DIRECT switches cannot be stored in memory. However, the set commands have priority over other control signals and are executed with precedence. Note that DPS units may not be controlled even when control signals are being delivered from this instrument.

3.6.3 If no START and END commands of (8) FLAG are given, the start point becomes STEP "0" and the end point becomes STEP "63".

3.6.4 If no END command of ⑧ FLAG is given, the instrument operates in the ∧ mode even when ⑯∧/∧switch is set in the ∧ mode.

On the contrary, if the START command is written in STEP 63, the instrument operates in the single-direction mode even when the switch is set in the both-direction mode position.

3.6.5 If the SKIP command of ⑧ FLUG is set when in ⑮ READ mode, operation is as follows:

For CONT: Data of STEP for which SKIP is set is not delivered and operation advances to the next STEP.

For STEP: No data is delivered. The display unit indicates data before skip and FLAG and STEP number for which SKIP command is set.

3.6.6 It is not recommended to use two or more commands of ⑧ FLAG at the same time. If used, operations are as follows:

(1) When all commands are set:

For step up operation, SKIP has priority. For step down operation, SKIP and START operate, this point becomes the START point, this STEP is skipped, and operation changes into step up mode.

(2) When SKIP and START are set:

Operation is the same as that of (1).

(3) When SKIP and HOLD or END are set or when SKIP, HOLD and END are set:

SKIP has priority.

(4) When START and END are set:

START has priority.

(5) When HOLD and END are set:

END operation is effected at the STEP and operation ends.

(6) When HOLD and START are set:

START operation is effected at the STEP and operation ends.

(7) When HOLD, END and START are set:

START operation is effected at the STEP and operation steps.

3.6.7 ⑩ LOAD switch can be thrown to the upper position and automatically held there. When this switch is held in this position, the AUTO STEP function is ineffective. Be sure to return the switch when the loading operation is over. To load only a single step, throw the switch to the lower position. The switch will automatically return to the neutral position to release from the load mode as you release your hand from the switch.

3.6.8 For ② DATA and ④ RANGE, refer to the instruction manual of the DPS units and ensure that operation is correctly done. If no RANGE is incorporated, it is not required to be specified.

Regarding columns, set them starting by the least-significant column.

Example: If the DPS unit is 9.99 V, control operation is done with the least-significant three columns of (2) DATA digital switches and the most-significant column is not required.

3.7 Instrument Operation

3.7.1 When the instrument power is turned on, the instrument circuits are in the reset state.

3.7.2 Functions of (8) FLAG switches

(1) START: When this command is set, data of the STEP is delivered and step up operation is done.

(2) END: When this command is set, data of the STEP is delivered and step down operation is done.

(3) HOLD: When this command is set, data of the STEP is delivered and the operation stops.

(4) SKIP: When this command is set, data of the STEP is not delivered and the operation advances to the next STEP.

3.7.3 When (12) RESET switch is pressed, all circuits except memory and commands of (19) DIRECT are reset to the initial state (the state that existed when the instrument power was turned on). This switch is for resetting of steps and timing.

3.7.4 Functions of (15) MODE Switch

(1) WRITE mode: Data is written in memory when data is set and (14) STROBE key is pressed and released. In

this case, STEP is automatically advanced by one step unless operation is in LOAD mode. The written data is delivered also to the output terminal.

(2) READ mode: Data is read from memory. When in STEP mode, data is delivered in the 1-step/1-strobe relationship irrespective of time setting. When in CONT mode, data is delivered cyclically in the time relationship with which data has been written.

Start operation is done with ⑭ STROBE key and stop operation is done with ⑫ RESET switch.

The ⟋ mode is for step up (sawtooth waveform in analog electronics). The ⋀ mode is for both step up and down (triangular waveform in analog electronics).

3.7.5 ⑰ OPERATION switch is for on/off control of the outputs of the instrument. When it is set in the OFF state, all digital outputs become the "H" level and, if the DPS unit connected to this instrument has the STANDBY function, the DPS unit becomes the STANDBY ON state. The DC voltage output of the instrument also becomes mechanical open.

3.8 Write Procedure

3.8.1 To Write Data in All of Steps 0 - 63

(1) Set ⑮ MODE switch in the WRITE FLAG & DATA position.

(2) Press ⑫ RESET switch to reset the instrument.

(3) Set ② DATA, ③ POL, ④ RANGE, ⑤ ADDRESS, ⑥ TIME, ⑦ STANDBY, and ⑧ FLAG as required.

(4) Press and then release ⑭ STROBE key. The data set in Step (3) will be written in STEP 0 and will be indicated on the display unit.

(5) Sequentially write data repeating the procedure of Steps (3) and (4). Steps will be automatically advanced by one step for each repetition.

3.8.2 To Write in Particular Step (in STEP 10, for Example)

(1) Set ⑮ MODE switch in the WRITE FLAG & DATA state.

(2) Set ② DATA, ③ POL, ④ RANGE, ⑤ ADDRESS, ⑥ TIME and ⑧ FLAG as required.

(3) Set ⑨ STEP setting switch at 10.

(4) Press ⑩ LOAD switch to load STEP 10. The display unit will indicate STEP 10.

(5) Press and them release ⑭ STROBE key so that the data written in Step (2) is written in STEP 10 and the display unit indicates the written data.

3.8.3 To Write ⑧ FLAG Only

(1) Set ⑮ MODE switch in the WRITE FLAG state.

(2) Set commands with ⑧ FLAG switches.

(3) With ⑨ STEP setting digital switches and ⑩ LOAD switch, load STEP for writing ⑧ FLAG command.

(4) Press and then release ⑭ STROBE key. The LED corresponding to the command will light, indicating that the flag has been written. In this case, however, TIME, DATA and other information indicated by the display unit are not always the contents of the STEP.

To use ⑧ FLAG, see Sub-section 3.9 "Functions of ⑧ FLAG."

3.9 Functions of ⑧ FLAG

START: With this command, data can be read starting by any required STEP. If no START command has been set in any STEP, reading starts by STEP 0.

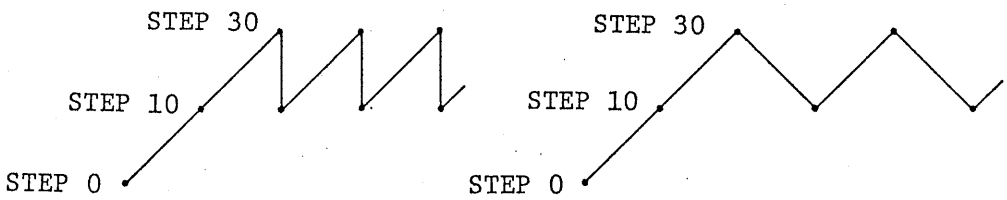
END: With this command, any required STEP can be read and terminated.

Examples of uses of START and END commands are shown in the following:

(1) When START is stored in STEP 10 and END is stored in STEP 30:

When operation is started from the reset state, reading starts by STEP 0. Once reading has passed STEP 10, reading thereafter is repeated between STEP 10 and STEP 30.

If reading is required to be started by STEP 10, load at first STEP 10 and then start reading.



(2) When END is stored in STEP 10 and START is stored in STEP 30:

When operation is started from the reset state, reading is repeated between STEP 0 and STEP 10.

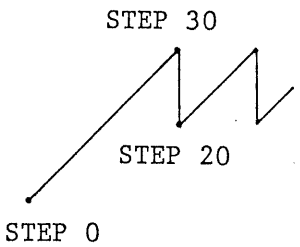
When operation is started by STEP 11 or further STEP, reading initially starts by STEP 11 but, thereafter, reading is repeated between STEP 30 and STEP 63 with STEP 30 as the start point.

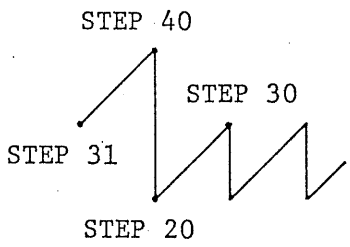
(3) When START is stored in STEP 10, START and END in STEP 20, and END in STEP 30:

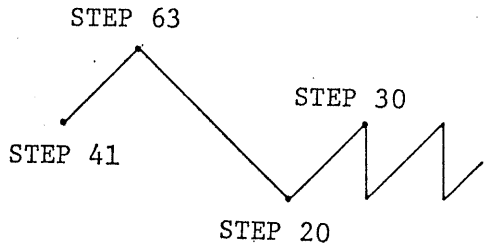
When reading is started by STEP 10, as the START command has the priority at STEP 20, reading advances to STEP 30. Thereafter, reading is repeated between STEP 20 and STEP 30.

(4) When START is stored in STEP 10 and STEP 20 and END is stored in STEP 30 and STEP 40:

- o When started by STEP 10, reading initially advances to STEP 30 and returns to STEP 20. Thereafter, reading is repeated between STEP 20 and STEP 30 with STEP 20 as the start point.
- o When started by STEP 31, reading initially advances to STEP 40 and then it returns to STEP 20. Thereafter, reading is repeated between STEP 20 and STEP 30 with STEP 20 as the start point.
- o When started by STEP 41 or further STEP, reading advances to STEP 63 and then retrogresses to STEP 20. Thereafter, reading is repeated between STEP 20 and STEP 30 with STEP 20 as the start point.







HOLD: This command is used to hold a certain STEP until the next START is effected. When this command is set together with the START and END commands at the same time, this command has the priority over the other two commands. By using this command, one-shot operation can be done when in the READ CONT mode. Examples of this mode of operation are shown in the following:

(1) To start by STEP 10 and end by STEP 30, store START in STEP 10 and HOLD and END in STEP 30.

To start by STEP 30 and end by STEP 10 on the contrary, store HOLD in STEP 10 in addition to the above setting. Set in the $\wedge\vee$ mode, load STEP 30, and press twice (14) STROBE key. When the key is pressed for the second time and released, reading starts by STEP 30 and it stops at STEP 10.

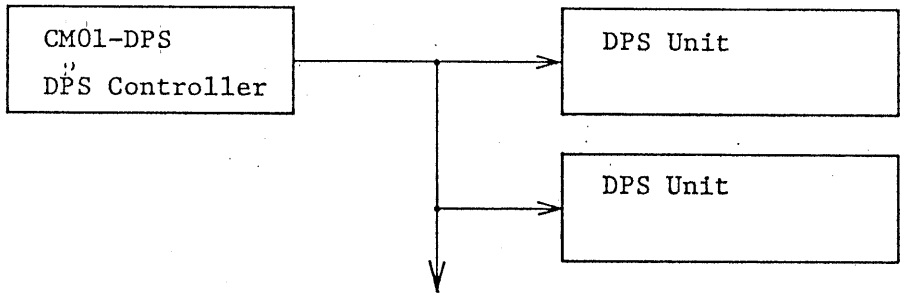
(2) To start by STEP 10, stop at STEP 30, and then returns to STEP 10 and end, store HOLD and START in STEP 10 and store END in STEP 30.

SKIP: This command is used to skip a certain STEP. This command is especially useful when a certain STEP is not required for a certain period but it is required afterward. This command has the priority over the HOLD, START, and END commands. When this command and other commands are set at the same time, other commands remain ineffective.

This command can be written together with data. To check the data of the STEP for which this command is set, this command must be released once.

3.10 Examples of Uses

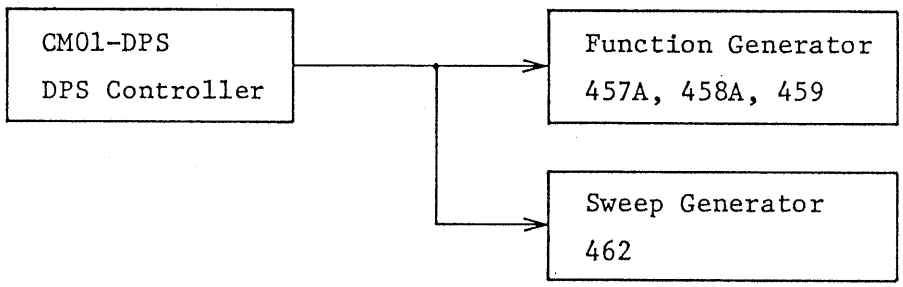
Example 1: To control DPS units



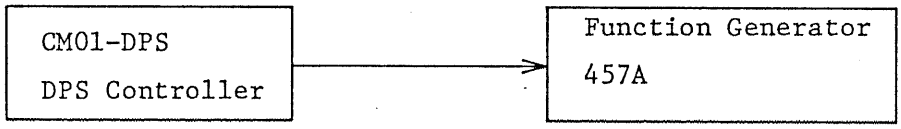
Up to 15 units can be controlled.

Example 2: For programmed control of generators

(1) Oscillating frequencies of generators can be program-controlled with this instrument. This can be done by connecting the DC voltage output terminal of this instrument to VCG (voltage-controlled generator) terminals of function generators.



(2) The output amplitude of a generator can be program-controlled. This can be done by connecting the DC voltage output terminal of this instrument to the VCA (voltage-controlled amplitude) terminal of a function generator.

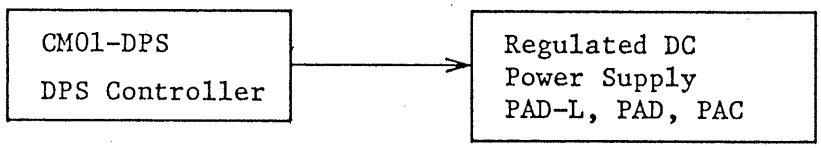


Example 3: To be used as a function generator

This instrument delivers a programmed DC voltage output and can be used as a function generator.

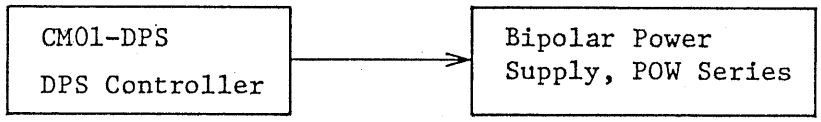
Example 4: For digital control of large output

(1) DC voltage/current control

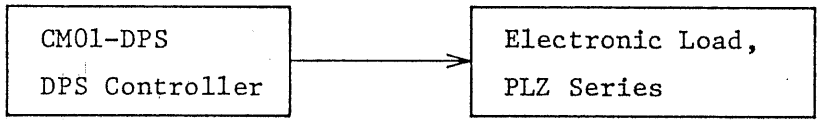


Minor modification is required.

(2) For bipolar power supply



(3) For constant-current electronic load



To use this instrument with other Kikusui power supplies, minor modifications may be required. Please contact your Kikusui Agent for such uses.

When this instrument is used in conjunction with other power supplies and response speeds are largely different between this instrument and slave power supplies, rise up response of the system may not be smooth.

When selecting slave power supplies, note that, due to electrolytic capacitors connected in the output circuits of the slave units, overshoots may result in the output circuits.

4. OPERATING PRINCIPLE

A block diagram of this instrument is shown in Figure 4-1.

WRITE Mode:

When the WRITE STROBE signal is generated, the 40-bit data set with digital switches and toggle switches is divided into 4-bit data by the DATA SELECTOR signal (sub-address signal) which has been generated by DATA SELECTOR 1 at the same time as the WRITE STOROBE signal has been generated. The 4-bit data is transferred to memory in the serial order of from FLAG to TIME ADDRESS.

As the data is written in memory, it also is read at the same time. The output data of memory is sequentially latched by the latch circuit which restores the original 40-bit data.

The data is sent to the display unit for monitoring.

READ Mode:

When the READ STROBE is applied, the sub-address circuit operates and data is read from memory. The read data is latched by the latch circuit which restores the original 40-bit data. This data is sent to the display unit via DATA SELECTOR 2 which selects this signal or the direct data for manual mode of operation. In this case, the FLAG is sent first and the subsequent control operation is dictated by this flag.

The selected data is fed to the control output terminal via the buffer or directly to the DC voltage output section.

When the next strobe is applied, main address is updated and reading is repeated in the same procedure as above.

The data sent to the DC voltage output section is converted into an analog signal by the D-A converter. The analyg signal is amplified by the amplifier and sent to the output terminal.

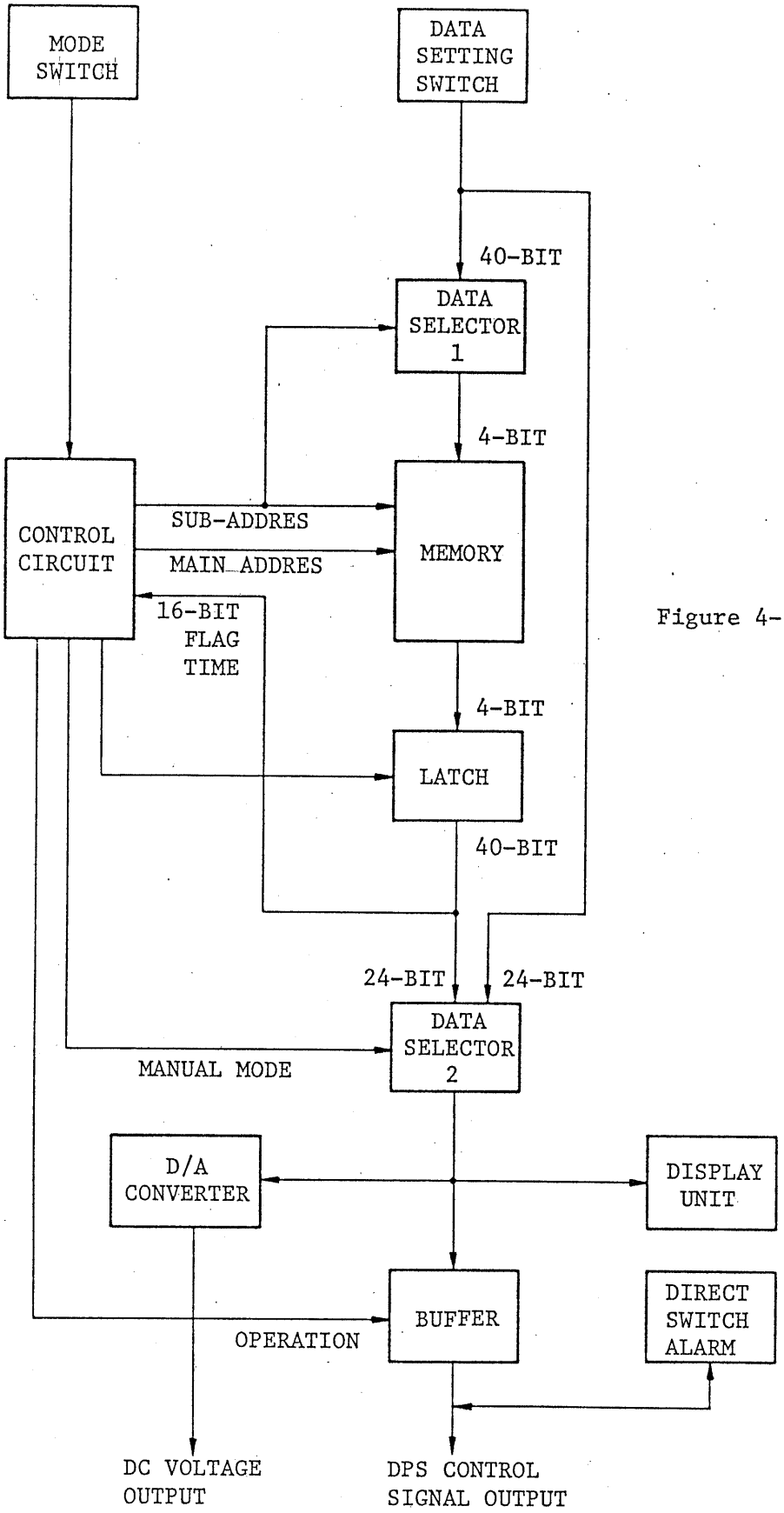


Figure 4-1

5. MAINTENANCE

5.1 Layout of Components

The cover can be removed after undoing six clamping-screws of each of top and bottom panels. To gain access to the internal components, remove the screws at the four corners of the handles. Layout of the componential units is as shown in Figure 5-1.

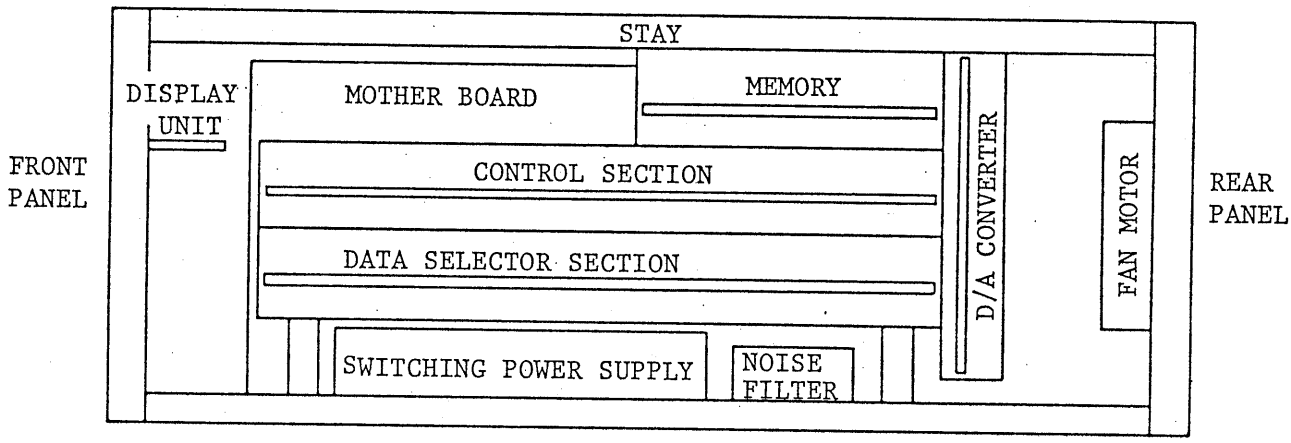


Figure 5-1

5.2 Adjustment and Calibration of DC Voltage Output Section

To ensure the accuracy of the DC voltage output section for a long time, it should be adjusted and calibrated periodically (once in 6 - 12 months). Calibration should be done in a stable ambient temperature condition of approximately 25°C (77°F).

For adjustment and calibration, allow more than 30 minutes of stabilization time after turning on the instrument power and, then, proceed as follows:

(1) Pull out the D-A converter unit from the instrument using the extension board. The above stabilization operation should be done in this state.

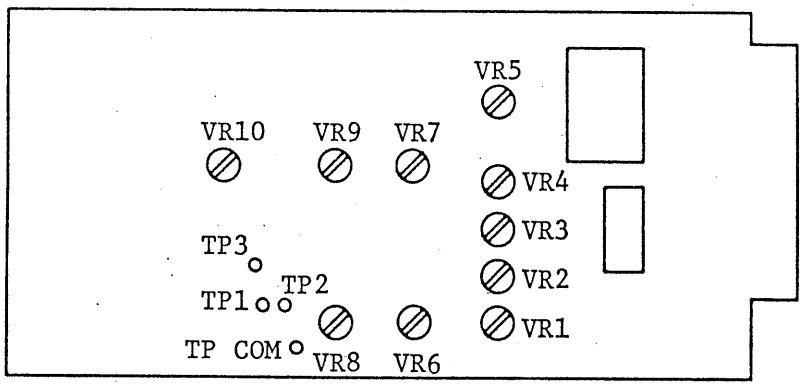


Figure 5-2

(2) Set (15) MODE switch to MANUAL mode, the STANDBY switch to OFF, the DIRECT STANDBY switch to OFF, and the OPERATION switch to ON.

(3) Connect a digital voltmeter (DVM) between TP COM and TP3. Use a DVM of 1-μV resolution.

(4) Set (2) DATA switches at "0000". Set (3) POL switch to "+". Adjust DVM reading to within ±10 μV with potentiometer VR7.

(5) Set (3) POL switch to "-". Adjust DVM reading to within ±10 μV with potentiometer VR9.

(6) Connect a DVM to the output terminal. Set (2) DATA switches at "0000". Adjust DVM reading to within ±10 μV. Check that DVM reading is within ±10 V regardless of setting of (3) POL switch either in the "+" or "-" position. If DVM reading is not within this tolerance, repeat the procedure of Steps (4) and (5) with the DVM kept connected to the output terminal.

(7) Set (2) DATA switch at "0999". Set (3) POL switch to "+". Adjust DVM reading at +999.0 mV with potentiometers VR5 and VR6.

(8) Set (2) DATA switches at "1000". Adjust DVM reading at +1.0000 V with potentiometer VR4.

(9) Set (2) DATA switches at "2000". Adjust DVM reading at +2.0000 V with potentiometer VR3.

(10) Set (2) DATA switches at "40000". Adjust DVM reading at +4.0000 V with potentiometer VR2.

(11) Set (2) DATA switches at "80000". Adjust DVM reading at +8.0000 V with potentiometer VR1.

(12) Set (2) DATA switches at "0999". Set (3) POL switch to "-". Adjust DVM reading at -999.0 mV with potentiometer VR8.