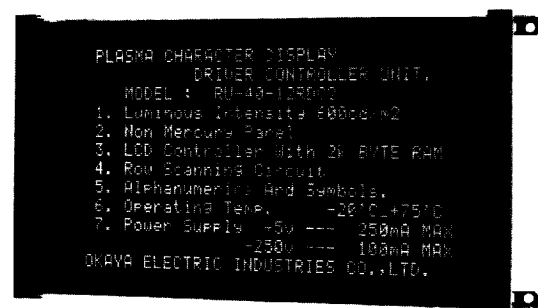
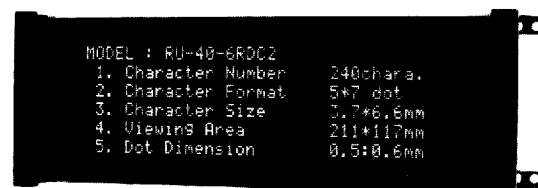
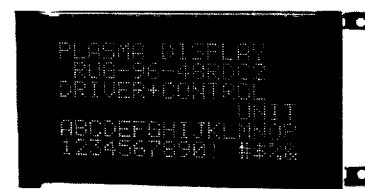
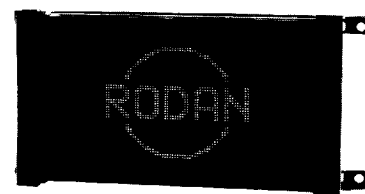


MODEL

RU-16-4RDC2	RUG-96-48RDC2
RU-32-8RDC2-2	RUG-224-96RDC2
RU-40-6RDC2	RUG-256-64RD12
RU-40-12RDC2	RUG-256-128RDC2
	RUG-320-64RD1
	RUG-320-168RDC2
	RUG-512-160RDC2

T-41-90



High-rel PDP Series include newly developed display panel models which employ lanthanum boride (LaB₆) as the cathodes. The display module is equipped with the driver circuits and the controller circuit.

The display panel is available in 2 types: the character type with the 5 x 7 dot format and the full-dot graphic type.

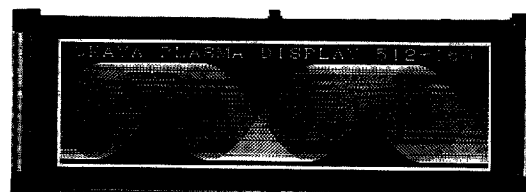
LaB₆ features a work function as low as 2.7eV, which reduces the discharge start voltage (E_z) of the PDP to a lower level. This places the LaB₆ cathode over the conventional Ni cathode. In addition, the LaB₆ cathode is a high secondary electron radiator (high-rel) that provides ultra-high brightness light emission of about 700 cd/m. Furthermore, this display panel does not use mercury (Hg) at all, thereby expanding the working temperature range -20~+75°C, and eliminates a potential safety hazard.

FEATURES

- Ultra-high brightness attained in the compact panel.
- Sharp display and sway-free dots minimizing eye fatigue.
- View angle as wide as 120°.
- High reliability.
- Working temperature range as wide as -20~+75°C.
- No mercury contained in the panel.
- LCD controller integrated.
- 50,000+ hours life.

APPLICATIONS

- Panel for counter service.
- Indicating terminal in production process.
- Interface of medical machinery.
- Terminal of NC machine tools.
- Automatic banking display terminal.
- Indicating terminal of various testers.



SPECIFICATIONS

Type	Character Column × Row	Dot Pitch V × H (mm)	Dot Dimensions V × H (mm)	Character Size (mm)	Display Area L × H (mm)	Outline L × H × D (mm)	Power Supply	LOW POWER CONTROLLER	Luminous intensity
RU-16-4RDC2	16 × 4	1.27	0.55 × 0.55	5.7 × 8.2	120 × 56	186 × 94 × 50	+5V 250mA (Max) -250V 50mA (Max)	CPU BUS LINE INTERFACE	approx. 885 cd/m ²
RU-32-8RDC2-2	32 × 8	1.0	0.55 × 0.55	4.6 × 6.6	222 × 93	296 × 135 × 50	+5V 250mA (Max) -250V 130mA (Max)	CPU BUS LINE INTERFACE	approx. 500 cd/m ²
RU-40-6RDC2	40 × 6	0.8 × 1.0	0.55 × 0.6	3.7 × 6.6	211 × 57	279 × 95 × 48	+5V 250mA (Max) -250V 100mA (Max)	CPU BUS LINE INTERFACE	approx. 885 cd/m ²
RU-40-12RDC2	40 × 12	0.8 × 1.0	0.55 × 0.6	3.7 × 6.6	211 × 117	279 × 155 × 41	+5V 250mA (Max) -250V 130mA (Max)	CPU BUS LINE INTERFACE	approx. 500 cd/m ²
RUG-96-48RDC2	96 × 48 (Dot)	1.27	0.55 × 0.55	—	122 × 60	186 × 94 × 50	+5V 250mA (Max) -250V 50mA (Max)	CPU BUS LINE INTERFACE	approx. 885 cd/m ²
RUG-224-96RDC2	224 × 96 (Dot)	1.0	0.55 × 0.55	—	226 × 96	296 × 135 × 50	+5V 250mA (Max) -250V 130mA (Max)	CPU BUS LINE INTERFACE	approx. 500 cd/m ²
RUG-256-64RD12	256 × 64 (Dot)	0.8	0.5 × 0.5	—	214 × 60.4	290 × 122 × 52	+5V 500mA (Max) -295V 80mA (Max)	Drivers only	approx. 200 cd/m ²
RUG-256-128RDC2	256 × 128 (Dot)	0.8	0.55 × 0.55	—	208 × 102	279 × 155 × 41	+5V 250mA (Max) -250V 130mA (Max)	CPU BUS LINE INTERFACE	approx. 500 cd/m ²
RUG-320-64RD1	320 × 64 (Dot)	0.9	0.65 × 0.65	—	288 × 58	380 × 94 × 25	+5V 350mA (Max) -240V 100mA (Max)	Drivers only	approx. 400 cd/m ²
RUG-320-168RDC2	320 × 168 (Dot)	0.6	0.4 × 0.4	—	191.4 × 100.2	269 × 145 × 34	+5V 250mA (Max) -250V 160mA (Max)	CPU BUS LINE INTERFACE	approx. 250 cd/m ²
RUG-512-160RDC2	512 × 160 (Dot)	0.65	0.45 × 0.45	—	332.1 × 103.3	406 × 156 × 34	+5V 250mA (Max) -250V 160mA (Max)	CPU BUS LINE INTERFACE	approx. 250 cd/m ²

※ RUG-512-256RD12 and RUG-640-480RD12 with CRT Interface are under final development stage, specifications upon request.

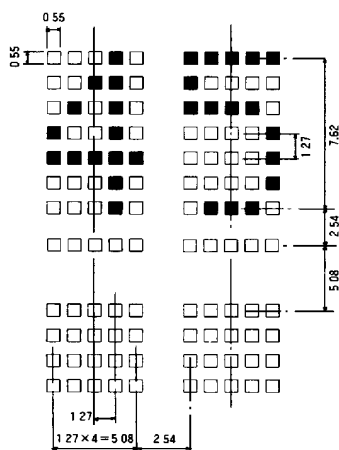
Operating temp: -20°C ~ +75°C Storage temp: -40°C ~ +85°C

DRIVER AND CONTROLLER SECTION

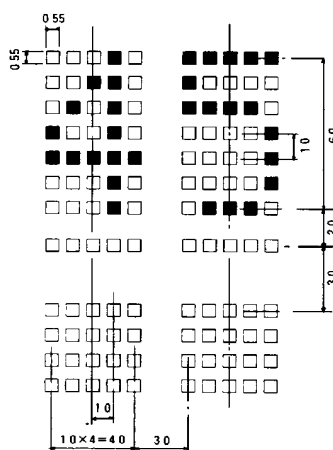
	RU-40-6-RDC2 · RU4012RDC2	RU-16-4RDC2 · RU-32-8RDC2-2 RUG-96-48RDC2 · RUG-224-96RDC2 RUG-256-128RDC2 · RUG-320-168RDC2 RUG-512-160RDC2
Controller LSI	LC7981	LC7980
Display Memory RAM	2K BYTE	8K BYTE
Input/output Level	TTL Level	TTL Level
Refresh Cycle	60Hz	60Hz

FORMAT

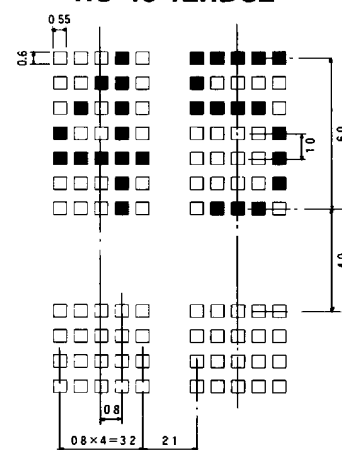
RU-16-4RDC2



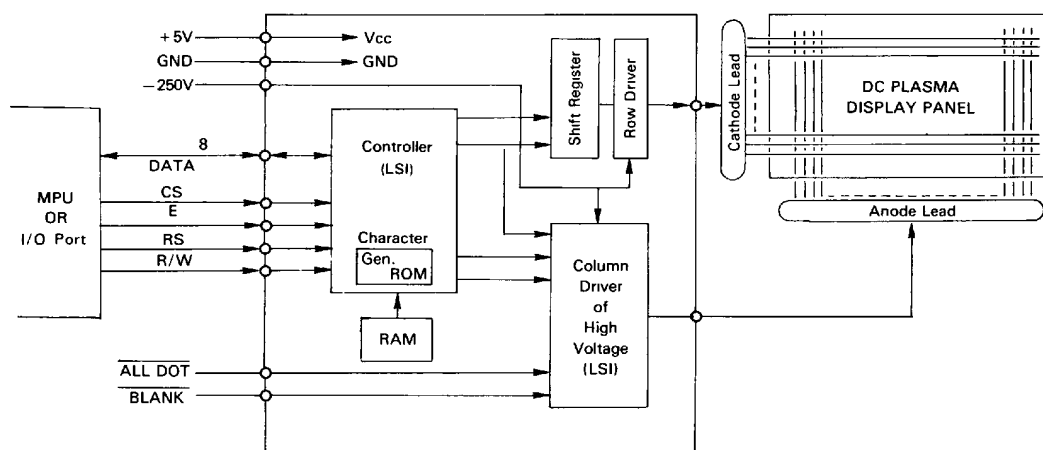
RU-32-8RDC2-2



RU-40-6RDC2
RU-40-12RDC2

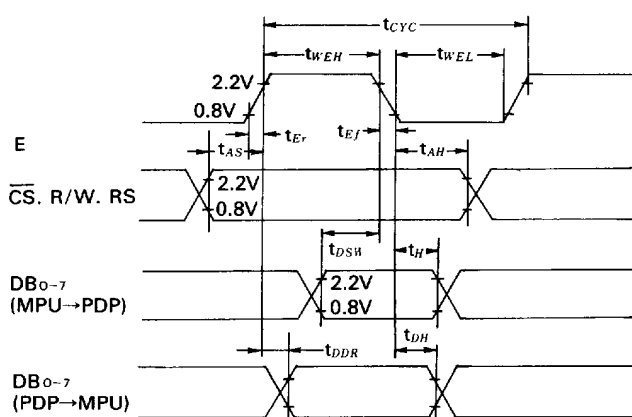


SYSTEM BLOCK DIAGRAM



TIMING CHARACTERISTICS

BUS READ/WRITE OPERATION (INTERFACE TO MPU)



Item	Symbol	Min.	Typ	Max.	Unit
Enable cycle time	t_{CYC}	1.0	—	—	μs
Enable pulse width	"High" level t_{WH}	0.45	—	—	μs
	"Low" level t_{WL}	0.45	—	—	μs
Enable rise time	t_{ER}	—	—	25	ns
Enable fall time	t_{EF}	—	—	25	ns
Setup time	t_{AS}	140	—	—	ns
Data setup time	t_{DSH}	225	—	—	ns
Data delay time	t_{DDR}	—	—	225	ns
Data hold time	t_{DH}	10	—	—	ns
Address hold time	t_{AH}	10	—	—	ns
Data hold time	t_{DH}	20	—	—	ns

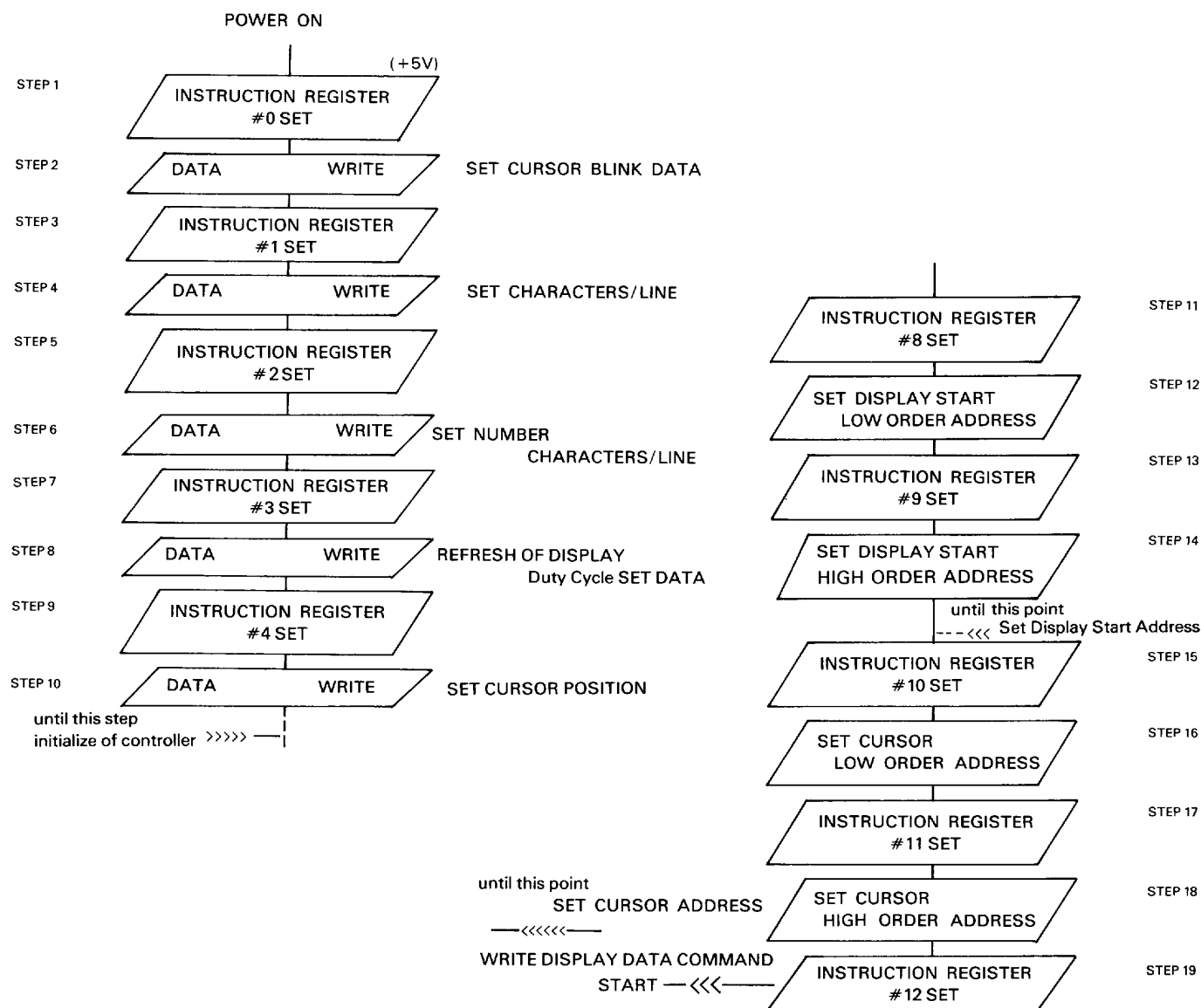
CONNECTOR

PIN No.	SIGNAL	PIN No.	SIGNAL
1	SG GROUND	14	R/W
2	D0	15	SG GROUND
3	D1	16	RS
4	D2	17	SG GROUND
5	D3	18	$\overline{CS}$
6	SG GROUND	19	BLANK
7	D4	20	ALL DOT
8	D5	21	VCC +5V
9	D6	22	VCC +5V
10	D7	23	GND
11	SG GROUND	24	GND
12	E	25	GND
13	SG GROUND	26	-250V

INITIALIZE OF CONTROLLER

The controller in this unit requires initialization in the specified sequence quickly after the power supply is turned ON. After the controller has been initialized, a clock signal is properly transmitted to the driver and causes the panel to normally turn ON. Never turn ON the high voltage panel power supply before the controller has been initialized, or when the controller is left incompletely initialized. This can lead to panel failure. To give the display control command, initialize the controller through the instruction register (IR) according to the following procedure, which consists of a series of 19 steps.

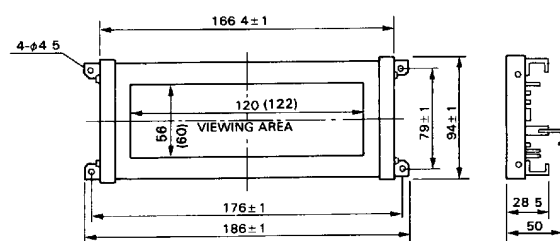
FLOWCHART TO INITIALIZE



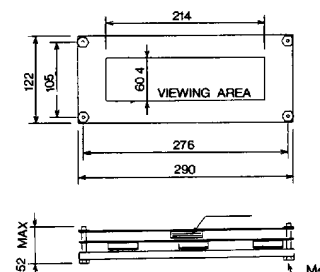
OUTER DIMENSION

(unit: mm)

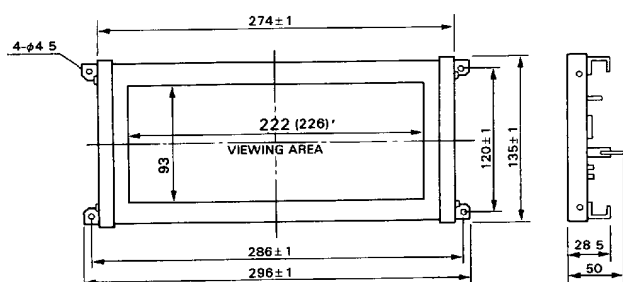
RU-16-4RDC2/RUG-96-48RDC2



RUG-256-64RD12

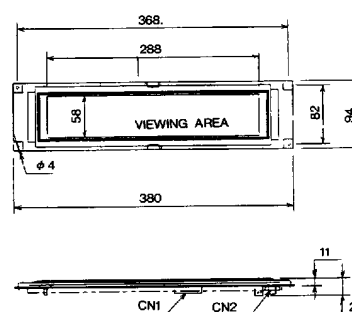


RU-32-8RDC2-2/RUG-224-96RDC2

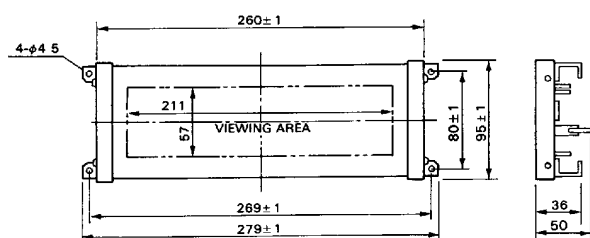


() RUG TYPE

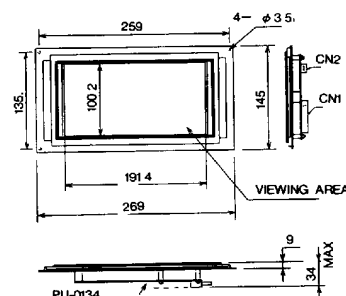
RUG-320-64RD1



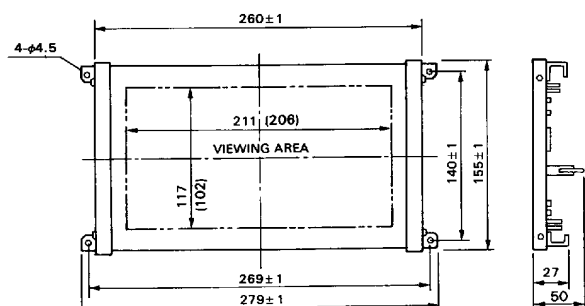
RU-40-6RDC2



RUG-320-168RDC2

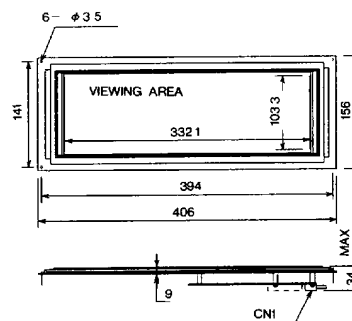


RU-40-12RDC2/RUG-256-128RDC2



() RUG TYPE

RUG-512-160RDC2



CHARACTER FONT OF INTERNAL ROM

Upper Lower	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
xxxx0000		0	1	2	3	4	5	6	7	8	9	A
xxxx0001		B	C	D	E	F	G	H	I	J	K	L
xxxx0010		M	N	O	P	Q	R	S	T	U	V	W
xxxx0011		X	Y	Z	[	\	]	^	_	`	a	b
xxxx0100		c	d	e	f	g	h	i	j	k	l	m
xxxx0101		n	o	p	q	r	s	t	u	v	w	x
xxxx0110		y	z	{		}	~					
xxxx0111												
xxxx1000												
xxxx1001												
xxxx1010												
xxxx1011												
xxxx1100												
xxxx1101												
xxxx1110												
xxxx1111												