28A AC Inrush Current Limiter

ICL-28R/28L

User's Manual

Video

(ICL-28R)

(ICL-28L)

■ Features

- 48A inrush limiting current, 28A continuous
- 180~264VAC AC input
- Integrated bypass relay, no simple NTC
- Internal thermal protection
- Installed on DIN Rail TS-35/7.5 or 15 (ICL-28R)
- -30~+70°C wide working temperature
- Over voltage category Ⅲ
- Operating altitude up to 5000 meters(Note. 2)
- 3 years warranty

■ Applications

- Allow connecting multiple power supply at same line
- Allows smaller and faster Circuit Breaker
- Capacitive load
- Protects against unintended tigger of circuit breaker

■ Description

The ICL-28 is a 28A inrush current limiter that can be used to reduce the high starting current due to capacitive load causing the circuit breaker to be false triggered. Several power supplies can be installed on the same AC line after the implementation of an ICL-28.

■ Model Encoding

ICL - 28 - R

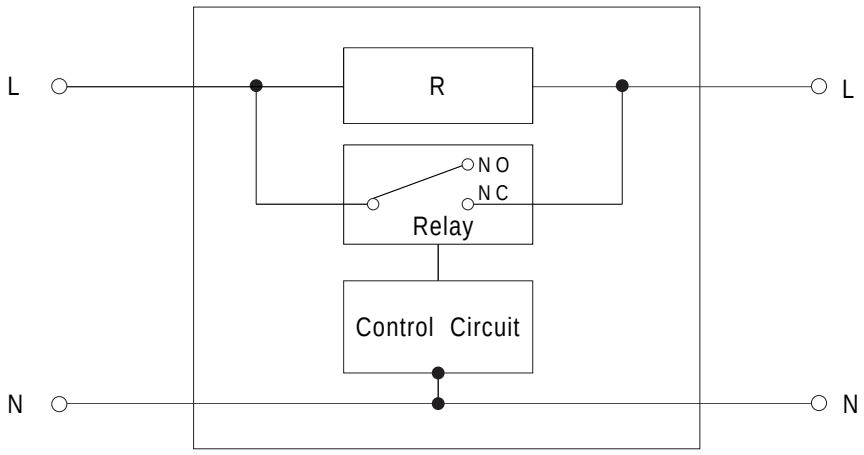
- Shape { R: DIN Rail type (Rail mounted)
  L: Linear type (Terminal block mounted)
- Continuous rated current
- Series name

28A AC Inrush Current Limiter ICL-28R/28L

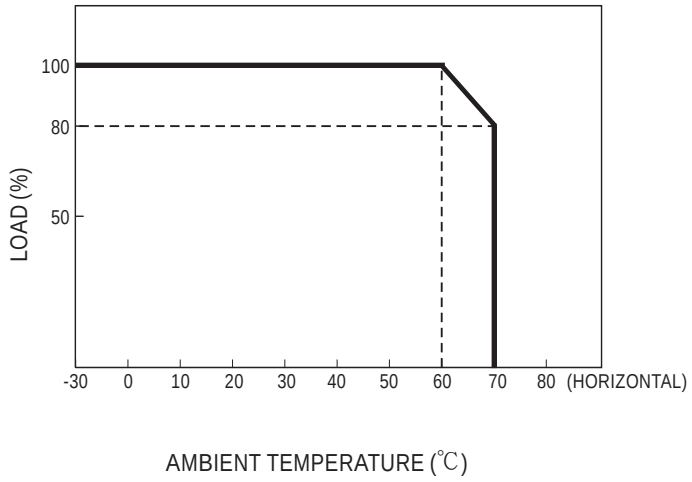
SPECIFICATION

MODEL		ICL-28R	ICL-28L	
AC INPUT VOLTAGE		180 ~ 264VAC	180 ~ 264VAC	
AC LINE FREQUENCY		47 ~ 63Hz		
INRUSH CURRENT LIMITING		48A		
AC CONTINUOUS RATED CURRENT		28A continuous		
AC INPUT POWER		6440VA (28A x 230VAC)		
AC INPUT CONSUMPTION		<2W at 264VAC, 50Hz input		
INTERNAL RELAY LIMITING TIME (TON POWER ON)		150±50ms		
INTERNAL RELAY	LIMITING CYCLES	3 cycle / 1 min		
	RELEASE TIME	100±50ms		
INTERNAL PROTECTION		Thermal fuse protects overload and fire		
ALLOWED CAPACITIVE LOAD		6000 μF max.		
WORKING TEMP.		-30 ~ +70℃ (Refer to "Derating Curve")		
WORKING HUMIDITY		20 ~ 90% RH non-condensing		
STORAGE TEMP.		-40 ~ +85℃		
TEMP. COEFFICIENT		±0.03%/℃ (0 ~ 60℃) RH non-condensing		
VIBRATION		10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes;		
		Mounting: Compliance to IEC60068-2-6		
OPERATING ALTITUDE Note. 2		5000 meters		
OVER VOLTAGE CATEGORY		Ⅲ; According to IEC62368-1; altitude up to 5000 meters		
POLLUTION DEGREE		2		
SAFETY STANDARDS		LVD BS EN/EN62368-1 approved		
SAFETY & EMC (Note.3)	EMC EMISSION	Parameter	Standard	Test Level / Note
		Conducted	BS EN/EN55032	Class B
		Radiated	BS EN/EN55032	Class B
		Harmonic Current	BS EN/EN61000-3-2	Class A
		Voltage Flicker	BS EN/EN61000-3-3	-------
	EMC IMMUNITY	BS EN/EN55024, BS EN/EN55035, BS EN/EN61000-6-2		
		Parameter	Standard	Test Level /Note
		ESD	BS EN/EN61000-4-2	Level 3, 8KV air; Level 2, 4KV contact, criteria A
		Radiated Susceptibility	BS EN/EN61000-4-3	Level 3, criteria A
		EFT/Burest	BS EN/EN61000-4-4	Level 3, criteria A
		Surge	BS EN/EN61000-4-5	Level 4,2KV/L-N, criteria A
		Conducted	BS EN/EN61000-4-6	Level 3, criteria A
		Magnetic Field	BS EN/EN61000-4-8	Level 4, criteria A
		Voltage Dips and interruptions	BS EN/EN61000-4-11	>95% dip 0. 5 periods, 30% dip 25 periods, >95% interruptions 250 periods
MTBF		1601.76K hrs min. MIL-HDBK-217F (25℃)	1626.62K hrs min. MIL-HDBK-217F (25℃)	
DIMENSION		52.5*90*54.5mm (L*W*H)	175*42*24mm (L*W*H)	
PACKING		0.16Kg; 80pcs/13.8Kg/1.23CUFT	0.155Kg; 84pcs/14Kg/0.91CUFT	
NOTE		1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature. 2. The ambient temperature derating of 3.5℃/1000m with fanless models and of 5℃/1000m with fan models for operating altitude higher than 2000m(6500ft). 3. The power supply is considered as an independent unit, but the final equipment still need to re-confirm that the whole system complies with the EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies." (as available on http://www. meanwell. com) ※ Product Liability Disclaimer : For detailed information, please refer to https://www.meanwell.com/serviceDisclaimer.aspx		

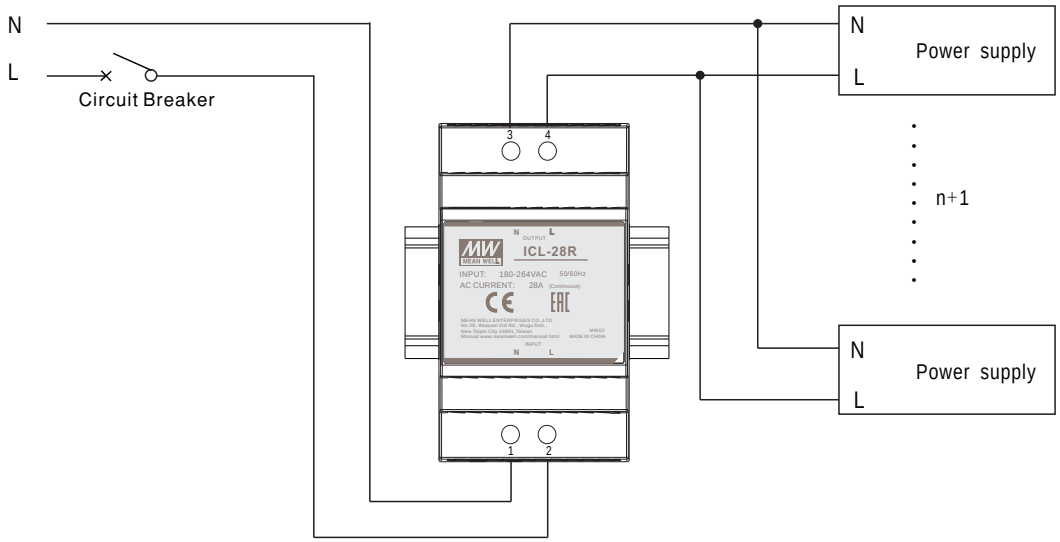
■ BLOCK DIAGRAM

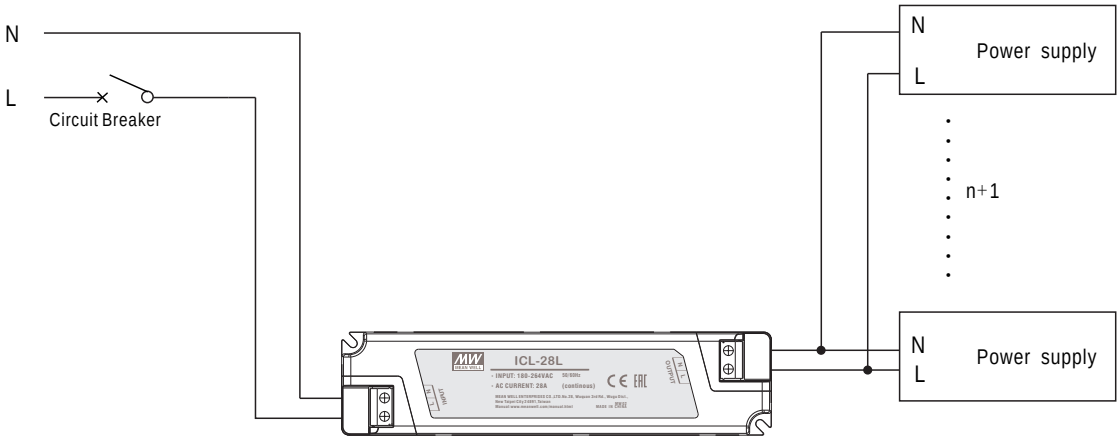


■ Derating Curve



■ APPLICATION DIAGRAM



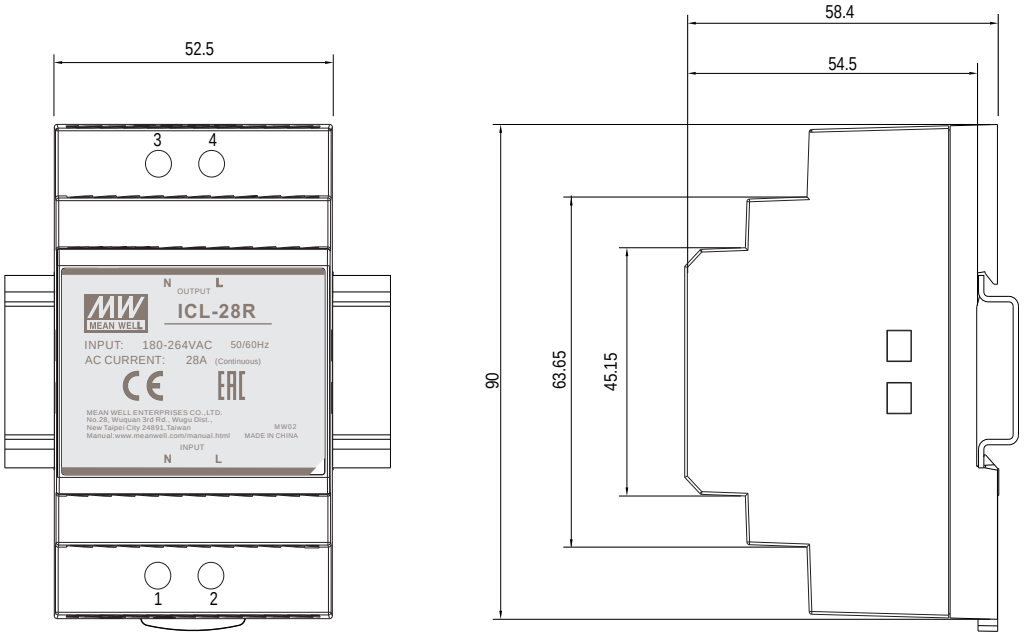


※ How many power supplys can be connected behind ICL-28R/ICL-28L?
Please refer to : http : //www.meanwell.com.

■ MECHANICAL SPECIFICATION

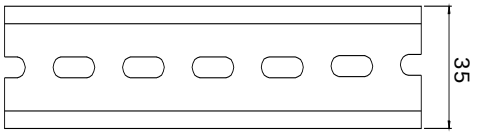
◎ ICL-28R(DIN Rail type)

Case No.ICL-28R Unit:mm



Terminal Pin No. Assignment

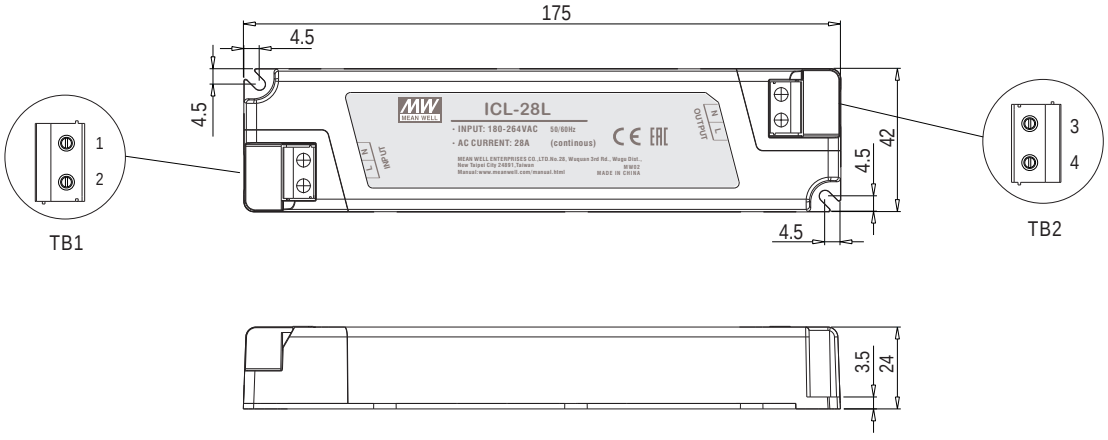
Pin No.	Assignment	Pin No.	Assignment
1	AC/N Input	3	AC/N Output
2	AC/L Input	4	AC/L Output



ADMISSIBLE DIN-RAIL:TS35/7.5 OR TS35/15

◎ ICL-28L(Linear type)

Case No.PLM-40 Unit:mm



Terminal Pin No. Assignment (TB1,TB2)
SWITCHLAB MB422-750 equivalent

Pin No.	Assignment	Pin No.	Assignment
1	AC/N Input	3	AC/N Output
2	AC/L Input	4	AC/L Output

INTRODUCTION

Since MEAN WELL released the first AC inrush current limiter in April 2019, the ICL-16R/L (16A) helped solve headaches of many end system designers regarding AC breakers. When the AC power system powers on a capacitive or inductive load, such as switching power supply, there is a temporary inrush current peak, which may cause AC circuit breakers to trip even though the continuous current draw is well below the breaker ratings. End system designers often have to oversize the breaker or separate load on multiple AC circuit breakers to ensure the system stability. The MEAN WELL ICL can be added after an AC circuit breaker to suppress the inrush current draw, which can help prevent AC circuit breakers from falsefully tripping, and it can help reduce the installation cost of the end system.

As a response to high demands from the market for higher current inrush current limiters, MEAN WELL quickly releases the ICL-28R/L series that can support higher current ratings than the ICL-16R/L, allowing more power supplies and larger capacitive loads to be installed on a single circuit breaker. Additionally, in order to satisfy installation requirements of different applications, MEAN WELL is releasing DIN rail type ICL-28R and linear type ICL-28L for customer selection.

FEATURES

- 48A inrush limiting current, 28A continuous
- 180~264VAC input
- Integrated thermal protection and bypass relay
- -30~+70℃ wide working temperature
- Operating altitude up to 5000m
- Overvoltage category III (OVCIII)

- 2 installation styles:

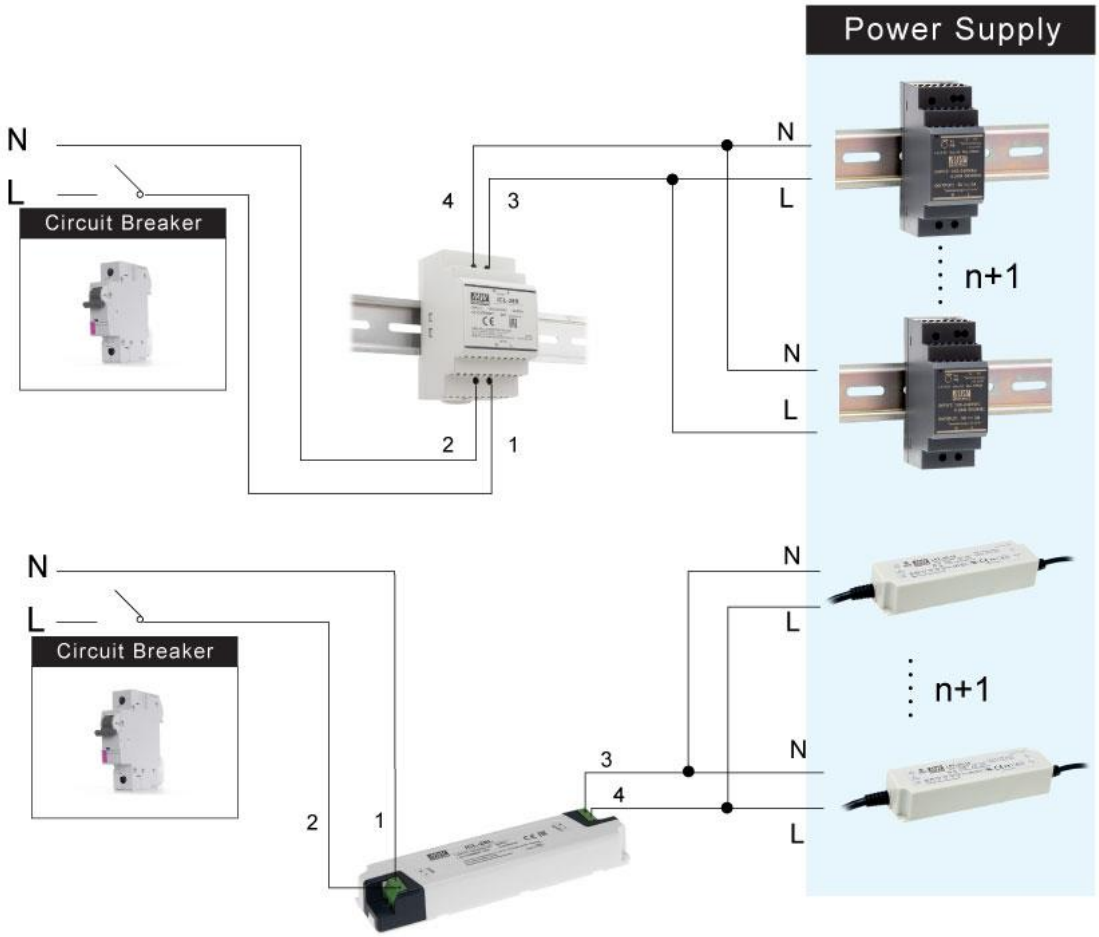
  DIN rail mount ICL-28R, suitable for installation on TS-35/7.5 or 15 DIN rails
  Linear shape ICL-28L, suitable for chassis mount (i.e. in the ceiling plenum)

- Dimensions:

  ICL-28R (W x H x D): 52.5 x 90 x 54.5mm
  ICL-28L (L x W x H): 175 x 42 x 24mm

- Safety approvals: EAC, CE

APPLICATION



Installation Manual

- **Type：ICL AC inrush current limiter（Series：ICL-16R, ICL-16L ,ICL-28R, ICL-28L）**

ICL-16R	INPUT: 180-264VAC	50/60Hz	AC CURRENT: 16A (Continuous)
ICL-16L	INPUT: 180-264VAC	50/60Hz	AC CURRENT: 16A (Continuous)
ICL-28R	INPUT: 180-264VAC	50/60Hz	AC CURRENT: 28A (Continuous)
ICL-28L	INPUT: 180-264VAC	50/60Hz	AC CURRENT: 28A (Continuous)

- **Introduction**

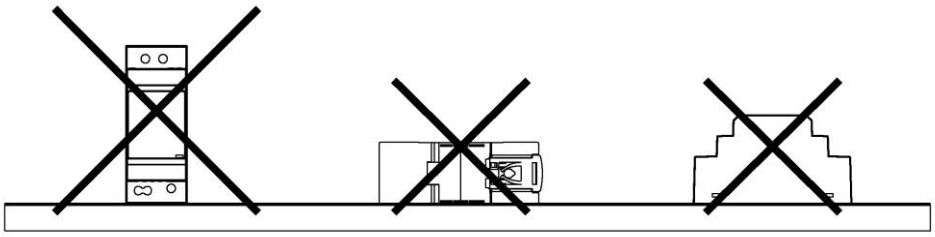
The ICL-R/L is an AC inrush current limiter that can be used to reduce the high starting current due to capacitive load or inductive causing the circuit breaker to be false triggered. Several power supplies can be installed on the same AC line after the implementation of an ICL-R/L.

- **Installation**

ICL-R：

（1）Always allow good ventilation clearances, 5mm left and right, 40mm above and 20mm below, around the unit in use to prevent it from overheating. Also a 10-15 cm clearance must be kept when the adjacent device is a heat source.

（2）The appropriate mounting orientation for the unit is vertical, the input terminals at the bottom and output on the top. Mounting orientations other than that, such as upside down, horizontal, or table-top mounting, is not allowed.



（3）Use copper wire only, and recommended wires are shown as below.

AWG	18	16	14	12	10
Rated Current of Equipment (Amp)	7	10	15	25	32
Cross-section of Lead(mm^2)	0.8	1.3	2.1	2.5	4
Note：Current each wire carries should be de-rated to 80% of the current suggested above when using 4-6 wires connected to the unit.					

Make sure that all strands of each stranded wire enter the terminal connection and the screw terminals are securely fixed to prevent poor contact. If the power supply possesses multi-output terminals, please make sure each contact is connected to wires to prevent too much current stress on a single contact.

（4）Use wires that can withstand temperatures of at least 80°C, such as UL1007.

（5）Recommended wire strapping length is 6mm (0.236”).

（6）Recommended screwdriver is 3mm, slotted type.

（7）The recommended torque setting for terminals is shown as below.

Model	I/P	O/P
ICL-16R	6.9 kgf-cm (6 Lb-in)	6.9 kgf-cm (6 Lb-in)
ICL-28R	5.1kgf-cm (4.43 Lb-in)	5.1kgf-cm (4.43 Lb-in)

Installation Manual

（8）Mounting Instruction：

Mount as shown in figure only, with input terminals down, or else sufficient cooling will not be possible.

Admissible DIN rail：TS35/7.5 or TS35/15

For rail fastening：

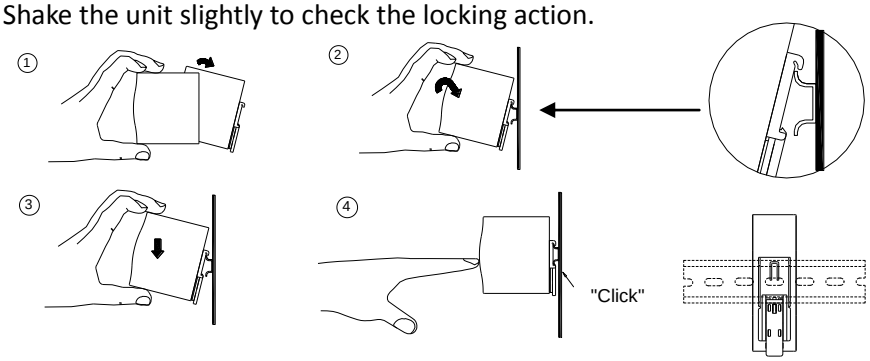
（a）Tilt the unit slightly rearwards.

（b）Fit the unit over top hat rail.

（c）Slide it downward until it hits the stop.

（d）Press against the bottom for locking.

（e）Shake the unit slightly to check the locking action.



（9）For other information about the products, please refer to www.meanwell.com for details.

ICL-L：

（1）Before any installation or maintenance work, please disconnect your system from the utility.
Ensure that it can't be re-connected inadvertently!

（2）Ventilation holes must be kept free from any obstructions. Also a 10-15 cm clearance must be kept when the adjacent device is a heat source.

（3）The recommended torque setting for terminals is shown as below.

Model	I/P	O/P
ICL-16L	5.7 kgf-cm (5 Lb-in)	5.7 kgf-cm (5 Lb-in)
ICL-28L	5.7 kgf-cm (5 Lb-in)	5.7 kgf-cm (5 Lb-in)

（4）Use copper wire only, and recommended wires are shown as below.

AWG	18	16	14	12	10
Rated Current of Equipment (Amp)	7	10	15	25	32
Cross-section of Lead(mm^2)	0.8	1.3	2.1	2.5	4
Note：Current each wire carries should be de-rated to 80% of the current suggested above when using 4-6 wires connected to the unit.					

Make sure that all strands of each stranded wire enter the terminal connection and the screw terminals are securely fixed to prevent poor contact. If the power supply possesses multi-output terminals, please make sure each contact is connected to wires to prevent too much current stress on a single contact.

（5）For other information about the products, please refer to www.meanwell.com for details.

Installation Manual

- **Warning / Caution !!**

"CAUTION：FOR USE IN A CONTROLLED ENVIRONMENT. REFER TO MANUAL FOR ENVIRONMENTAL CONDITION" ATTENTION: A UTILISER DANS UN ENVIRONNEMENT CONTROLE. REFEREZ VOUS AU MANUEL POUR LES CONDITIONS D'ENVIRONNEMENT.

（1）Risk of electrical shock and energy hazard. All failure should be examined by a qualified technician. Please do not remove the case of the power supply by yourself!

（2）Risk of electric arcs and electric shock (danger to life). Connecting both the primary and the secondary sides together is not allowed.

（3）Risk of burn hazard. Do not touch the unit in operation and shortly after disconnection!

（4）Risk of fire and short circuit. The openings should be protected from foreign objects or dripping liquids.

（5）Only install the unit in a pollution degree 2 environment (Note.1).

（6）Please do not install the unit in places with high moisture or near the water.

（7）The maximum operating temperature is 70°C for the ICL-16R/16L and 60°C for the ICL-28R/28L, please do not install the unit in places with high ambient temperature or near fire source.

（8）Disconnect system from supply voltage:

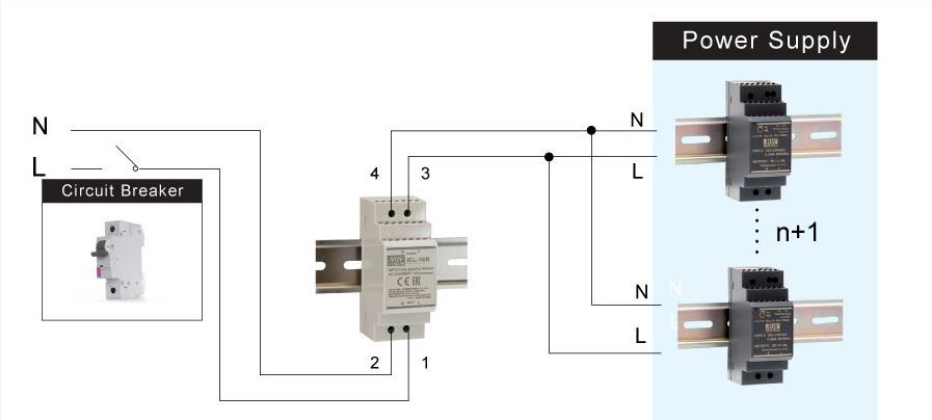
Before commencing any installation, maintenance or modification work: Disconnect your system from supply voltage. Make sure that inadvertent connection in circuit will be impossible!

Note.1: Pollution Degree 2 applies where there is only non-conductive pollution that might temporarily become conductive due to occasional condensation. Generally refer to dry, well-ventilated locations, such as control cabinets.

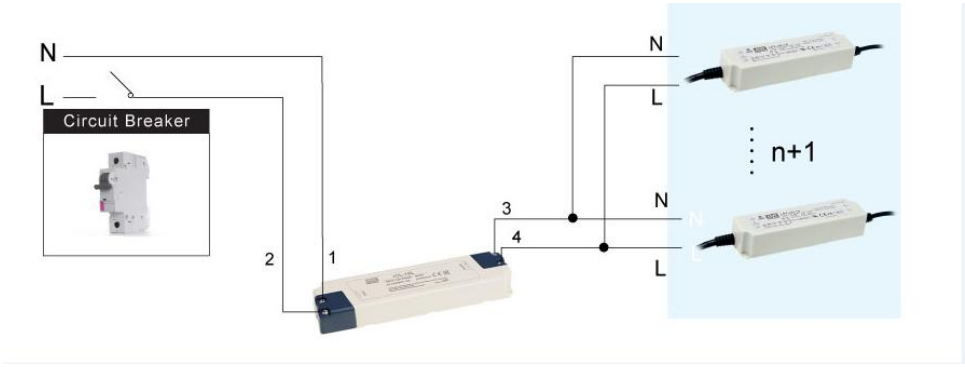
- **Application Diagram**

（1）ICL for Single phase application

ICL-R：

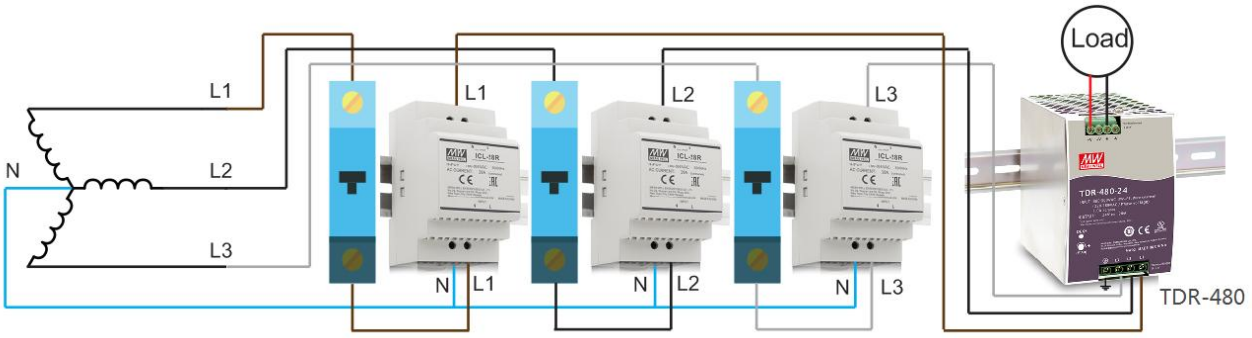


ICL-L：



Installation Manual

（2）ICL for Three phase application



Note: ICL-16 series is not suggested for 3 phase application.

- **Application Manual**

The maximum capacitive load and maximum possible rated current limit the number of power supplies that can be connected. Often, it is the rated currents that represent the decisive factor, because the inrush current limiters can handle capacitive loads as high as 2500uF/6000uF.
The input capacity of the power supplies is largely determined by primary-side storage capacitors. With MEANWELL, these capacitors are marked with the position code C5, and their capacitance can be found in the test report on the MEANWELL's website.
Regarding the q'ty of PSU can be connected behind ICL-16/28, you could quickly make an rough evaluation by following process below.

How many industrial SMPs can be connected behind ICL-16R?

Step 1

- Please check ICL-16R following spec information first.
  -AC continuous rated current
  -Capacitive load

SPECIFICATION

MODEL	ICL-16R	
AC INPUT VOLTAGE	180 ~ 264VAC	
AC LINE FREQUENCY	47 ~ 63Hz	
AC PEAK CURRENT	23A±5%	
AC CONTINUOUS RATED CURRENT	16A continuous	16A
AC INPUT POWER	3680V (16A x 230VAC)	
AC INPUT CONSUMPTION	<1W at 264VAC input	
INTERNAL RELAY LIMITING TIME (TON POWER ON)	300±50ms	
INTERNAL RELAY LIMITING CYCLES	10 cycles / minute	
INTERNAL RELAY RELEASE TIME	500±50ms	
INTERNAL RELAY LIMITING INTERVAL	>900ms	
INTERNAL RELAY SWITCHING CYCLES	100K times max.	
INTERNAL PROTECTION	Thermal fuse protects overload and fire	
CAPACITIVE LOAD	2500μF max.	2500 μF

ary

Installation Manual

How many industrial SMPs can be connected behind ICL-16R?

Step 2
Check following information of connected PSU from product spec and test report on MEANWELL web-site

Example: **SDR-120-24**

SPECIFICATION

MODEL		SDR-120-12	SDR-120-24	SDR-120-48
OUTPUT	DC VOLTAGE	12V	24V	48V
	RATED CURRENT	10A	5A	2.5A
	CURRENT RANGE	0 ~ 10A	0 ~ 5A	0 ~ 2.5A
	RATED POWER	120W	120W	120W
	PEAK CURRENT	15A	7.5A	3.75A
	PEAK POWER Note.6	180W (3 sec.)		
	RIPPLE & NOISE (max.) Note.2	100mVp-p	100mVp-p	120mVp-p
	VOLTAGE ADJ. RANGE	12 ~ 14V	24 ~ 28V	48 ~ 55V
	VOLTAGE TOLERANCE Note.3	±1.0%	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.5%	±0.5%
	LOAD REGULATION	±1.0%	±1.0%	±1.0%
	SETUP, RISE TIME	1500ms, 60ms/230VAC 3000ms, 60ms/115VAC at full load		
	HOLD UP TIME (Typ.)	20ms/230VAC 20ms/115VAC at full load		
INPUT	VOLTAGE RANGE Note.7	88 ~ 264VAC 124 ~ 370VDC		
	FREQUENCY RANGE	47 ~ 63Hz		
	POWER FACTOR (Typ.)	0.93/230VAC 0.96/115VAC at full load		
	EFFICIENCY (Typ.)	89%	91%	90.5%
	AC CURRENT (Typ.)	1.4A/115VAC 0.7A/230VAC		
	INRUSH CURRENT (Typ.)	35A/115VAC 70A/230VAC		
	LEAKAGE CURRENT	<1mA / 240VAC		

Check AC input current spec of **SDR-120-24** and do calculation with the rated current of ICL-16

16A/0.7A =22.8... ➡ 22 units

How many industrial SMPs can be connected behind ICL-16R?

Step 3
Check following information of connected PSU from product test report on MEANWELL web-site

Example: **SDR-120-24**

SPEC | REPORT | CERTIFICATE | OTHERS

SDR-120-12 | SDR-120-24 | SDR-120-48

MEAN WELL 120W Single Output Industrial DIN RAIL with PFC Function **SDR-120 series**

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	TEMPERATURE RISE TEST	MODEL : SDR-120-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P: 230VAC O/P: FULL LOAD Ta= 27.6 'C 2. HIGH AMBIENT BURN-IN : 3.5 HRS I/P: 230VAC O/P: FULL LOAD Ta=59.7 'C			

NO	Position	P/N	ROOM AMBIENT Ta= 27.6 'C	HIGH AMBIENT Ta= 59.7 'C
1	L2	TR909	41.6'C	72.5'C
2	LF1	TR790-R1	47.9'C	79.1'C
3	LF2	TR910	44.8'C	76.4'C
4	BD1	BD 4A/800V GBU408	53.6'C	83.8'C
5	D1	BYV29X-600 7A/600V	47.9'C	79.4'C
6	C5	100u/400V 105'C 18*25 KMG	56.8'C	85.8'C
7	D3	3A/600V 1N5406	69.3'C	100.6'C
8	Q2	STP14NM65N 12A/650V	53.8'C	85.2'C

100 µF

Check C5 capacitor value and do calculation with acceptable capacitive load of ICL-16R

2500 µF /100 µF =25 ➡ 25 units

Summary :

The recommended number of units is the smaller value of results from Step 2 and 3 multiplied by a factor of 0.9.

For SDR-120-24, the recommendation is : 22*0.9=19.8 ➡ 19 units

For other model, you can use the same method to calculate it.

Installation Manual

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ISO-9001 CERTIFIED
Your Reliable Power Partner

Suggested Maximum quantity of LED power supplies with ICL-16								
Power Supply Rating	10A B curve	10A B curve + ICL16	10A C curve	10A C curve + ICL16	16A B curve	16A B curve + ICL16	16A C curve	16A C curve + ICL16
16W	8	40	15	40	14	57	24	57
25W	7	40	13	40	12	57	21	57
40W	7	33	12	33	12	48	20	48
60W	5	25	8	25	8	36	14	36
75W	3	23	5	23	5	33	8	33
80W	1	23	3	23	3	33	6	33
90W	2	20	3	20	4	28	6	28
100W	2	18	5	18	4	26	8	26
120W	3	16	5	16	5	24	9	24
150W	2	13	4	13	4	19	7	19
185W	2	12	4	12	4	18	7	18
200W	2	8	3	8	4	12	6	12
240W	1	6	2	6	2	9	4	9
320W	0	6	1	6	1	8	2	8
480W	1	4	1	4	2	5	3	5
600W	0	3	1	3	1	4	2	4

Suggested Maximum quantity of LED power supplies with ICL-28								
Power Supply Rating	20A B curve	20A B curve + ICL28	20A C curve	20A C curve + ICL28	25A B curve	25A B curve + ICL28	25A C curve	25A C curve + ICL28
16W	17	80	30	80	21	100	37	100
25W	15	80	26	80	18	100	32	100
40W	15	66	25	66	18	83	31	83
60W	10	50	17	50	12	62	21	62
75W	6	47	10	47	7	58	12	58
80W	3	47	7	47	3	58	9	58
90W	5	40	7	40	6	50	9	50
100W	5	36	10	36	6	45	12	45
120W	6	33	11	33	7	41	14	41
150W	5	26	8	26	6	33	10	33
185W	5	25	8	25	6	31	10	31
200W	5	16	7	16	6	20	9	20
240W	2	13	5	13	2	16	6	16
320W	1	12	2	12	1	15	3	15
480W	2	8	3	8	2	10	4	10
600W	1	6	2	6	1	7	3	7